MediaMatrix®

A Division of Peavey Electronics Corporation

nion™

Network Input Output Node

NION Hardware Manual

Version 1.6.4b.1

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Chapter 1

About this guide

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Scope

This guide describes how to physically install a NION and configure it with basic settings.

Once you have completed the installation, we recommend that you refer to the NWare User Guide to see how to design an audio solution and download settings to the NION.

Documentation conventions

The following are used in the documentation to highlight particular sections of information.

Tip: Suggests alternative ways of completing a task and shortcuts that might not otherwise be obvious.

Note: Indicates important information that should not be ignored.

Caution: Indicates that unless you are careful, your actions could result in equipment damage or loss of data.

Warning: Indicates that unless you are careful, your actions could result in injuries to personnel.

Manual set

This guide is part of the MediaMatrix documentation set. The table below shows which user guides to refer to when you want to find out how to accomplish various tasks.

Note: Several associated products are required to complete a working MediaMatrix system. Both Peavey products and third party products must be installed correctly for the system to operate in accordance with published specifications.

Tasks	Relevant Guides
Building up an audio system using devices available from the NWare device tree. You may be unfamiliar with some aspects of NWare or new to NWare altogether. You want to read about the features of NWare and want step-by-step instructions, not just reference information.	NWare User Guide
Building up an audio system using devices available from the NWare device tree. You are familiar with NWare devices and when to use them. You want to look up settings to see what they are for.	NWare Device Reference
Finding out about new features added to releases of MediaMatrix products, including NWare and NION.	NWare Release Notes
Using different protocols, such as PASHA and SNMP, to remotely control and monitor devices in an NWare project.	External Control User Guide
Understanding how Pandad works and managing it on your network.	Pandad Administrator Guide
Understanding in detail the features of the NION digital audio processor and how to configure it.	NION Hardware Manual
Unpacking and initial configuration of a NION digital audio processor.	NION nE Quick Set-Up Guide
Physical installation and initial configuration of a CAB 4n.	CAB 4n Hardware Manual
Physical installation and initial configuration of a CAB 8n.	CAB 8n Hardware Manual
Physical installation of an nControl unit and	nControl Hardware Manual

Tasks	Relevant Guides
configuration of associated software.	
Physical installation of an nTouch 180 and configuration of associated software.	nTouch 180 Hardware Manual
Physical installation of an nTouch 60 and configuration of associated software.	nTouch 60 Hardware Manual
Physical installation and initial configuration of an xControl LCD.	xControl LCD Hardware Manual
Understanding how CobraNet works.	Working with CobraNet
Physical installation of an nWall device and connection to the network.	nWall Hardware Manual

Software, firmware and manual versions

The information in this manual is based on a specific software version (for PC software, like NWare) or firmware version (for hardware devices, like NION). The version of the manual, shown on the front page, includes the software or firmware version and the revision number of the manual itself.

Manual version 1.6.1f.0 (example)	
1.6.1f	Software or firmware version.
0	Manual revision number. Revision 0 is the first version to be published for a release. Revision 1,2 etc. indicate that the manual is a replacement for the previous version published for this release.

Note: To reduce the risk of compatibility problems, we recommend that all the hardware devices (NioNodes, nControl nodes etc.) on the network run the same firmware version, and that the version matches the version of NWare you are running.

Sending feedback

We are always looking for better ways to provide information about our products, and your input is always appreciated. If you have a comment about this manual or would like to make a suggestion, please write to:

Peavey Electronics Corp.,
MediaMatrix Division,
5022 Hartley Peavey Drive,
Meridian, MS 39305, USA.

Phone: 601.483.9548
Phone (toll free): 866.662.8750
Fax: 601.486.1678

or *email us* (*mailto:mmtechsupport@peavey.com*).

Thank you again for using MediaMatrix.

Chapter 2

Safety Instructions and safety warnings

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Safety Warnings

To prevent electrical shock or potential fire hazards, do not expose this product to moisture or rain.

Do not use any other power supply or cable other than the one provided with this unit. If the plug does not fit your outlet, consult an electrician for replacement of the obsolete outlet.

Do not remove the cover of the unit. There are no user-serviceable parts inside. Refer service to qualified personnel.

Do not use solvents or other cleaners to clean the unit. Basic external care requires only a damp cloth. Disconnect the power supply cable before cleaning.

If the power supply cord or connector has been damaged, if the unit has been dropped, or if a foreign substance has gained access to the interior electronic and electrical components, this product should be inspected by a qualified service technician.

This product should not be installed or placed near a source of heat.

Power supply cords and associated connectors should be unplugged from the power source when the unit is not used for long periods of time or stored. Protect power supply cords and connectors from being walked on or pinched.

This product is designed for EIA rack mounting only. Use racks of sufficient depth and width to accommodate proper airflow and cable harnessing.

It is important to keep the rack stable. If this unit is the only one in the rack, install it at the bottom. If there are several devices to install in the rack, load the rack from the bottom up.

Care should be taken to ensure that the installation is clear of possible sources of contamination. Make sure that the product's ventilation openings are not exposed to possible sources of liquid, gases, or other contaminants.

When dressing off wiring harnesses, take care with CAT 5 cables. Do not tie-wrap bundles of CAT 5 wire too tightly. Leave plenty of room for bends, allowing the cable to progress naturally from the RJ-45 connector. Creating tightly wrapped CAT 5 wire bundles can cause data transmission errors.

It is possible for line level audio and data signals to contaminate microphone level signals. We therefore recommend that the cabling for the different signal types is separated.

This product should be installed so that its mounting position does not interfere with proper ventilation. Do not block air intake or exhaust vents.

Exposure to extremely high noise levels may cause permanent hearing loss. Individuals vary considerably in susceptibility to noise-induced hearing loss, but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a sufficient time. We recommend that all persons exposed to equipment capable of producing high sound pressure levels use hearing protectors.

The *U.S. Government's Occupational and Health Administration (OSHA)* (*http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735*) has specified the following permissible noise level exposures:

Duration Per Day in Hours	**Sound Level dBA, Slow Response**
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼ or less	115

Keep these instructions for future reference.

Chapter 3

Before you start

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Important network considerations

This product is designed to operate on a network backbone or infrastructure. The design, implementation and maintenance of this infrastructure is critical to correct operation and performance of the product. Peavey Electronics does not support nor service network cabling, hubs, switches, patch bays, wall plates, connector panels or any other type of network interconnect device. Please ensure that these components and their associated installation techniques have been properly designed and installed for audio and network applications.

Refer to the document *Working with CobraNet* for more information.

Power outage and surge protection

We make the following recommendations for the power source:

- Use an uninterruptable power supply (UPS) to protect against power outages.
- Use a power surge protection device, such as a *Surge-X* (*http://www.surgex.com*). This provides protection from destructive spikes, surges and inductive transients.

Thank You!

Thank you for purchasing this MediaMatrix product. It is designed to provide years of trouble-free operation and high quality performance. We are confident that you will find this product and other MediaMatrix products to be of the highest quality.

Warranty Registration

Please take a few minutes and fill out the warranty registration card. Although your warranty is valid without the registration, the information you provide with the form is crucial to our support group. It enables us to provide better service and customer support, and to keep you informed of new product updates.

Tip: Refer to the warranty statement at the rear of this manual for details of what your warranty includes and what the limitations are.

What's in the box?

NION series products are packaged in a single container. This container includes the following items:

- NION n6, NION n3, NION nX or NION nE Network Input/Output Node
- IEC removable power supply cable (120 VAC domestic)
- Shielded CAT 6 cable, 1’
- Software installation CD
- User manual/literature package.

If any of these items are missing, please contact your Authorized Peavey MediaMatrix contractor/dealer.

Chapter 4

Introduction to NION

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Description

NION (n. nee-on) is a programmable digital audio processing node designed for professional and commercial audio and communications applications.

The internal processing core is supported by a wide range of features including MediaMatrix's scalable I/O architecture, a modular I/O scheme that supports a variety of optional plug-in cards for maximum versatility.

Each of the module bays supports 8 simultaneous analog audio channels, while the integrated CobraNet port provides further channels, depending on the model.

NION is built on an embedded Linux architecture designed for stable, efficient and robust performance. Low-latency audio across all I/O ports makes NION perfect for performance audio projects, in addition to applications where a large amount of audio processing is required.

Multiple NIONs can be managed using NWare, a Windows-based program that works with multiple nodes across an Ethernet network. Additional support for third party control and SNMP management tools is included.

An intuitive front panel interface features an LCD display, soft buttons and rotary encoder to enable access to common system functions. Additional control interfacing is provided by both RS-232 and RS-422/485 ports, while a configurable GPIO system allows interfacing with hard contacts and logic systems.

Note: The front panel is fitted to all NION models apart from the NION nE. This model is managed using the web interface and NWare.

Features

- Floating point DSP Engine with 6 DSP chips (NION n6) or 3 DSP chips (NION n3, NION nX)
- World-famous MediaMatrix audio algorithms
- 96 channels total audio I/O (NION n3, NION n6) or 80 channels total audio I/O (NION nX)
- 32 bits processing engine
- 24 bit conversion
- X-DAB bus (NION n3, NION n6) supports up to 448 bi-directional audio channels

Note: It is possible to exceed the 448 channel limit, but it is not recommended. Testing has shown that using a greater number of channels can produce

- Front panel interface with intuitive user input controls (n3, n6 and nX models only)
- Robust Linux embedded system controller
- Integrated flash-based storage
- Supports optional hard-disk storage systems
- Windows configuration and control client
- Full support for SNMP network management tools

unexpected results.

- Low latency audio performance
- Integrated, modular CobraNet I/O
- Network-centric architecture
- Supports centralized, distributed or hybrid processing
- Integrated serial support
- Scalable I/O Architecture with four 8-channel bays (NION n3, NION 6) or two 8-channel bays (NION nX)
- Supports sample rates of 48 kHz and 96 kHz
- Universal industrial-grade power supply
- Software support for large-scale multi-node systems
- Advanced DSP compiler
- Configurable GPIO with DIN rail package
- Transparent control grouping across physical nodes
- Supports redundant, self-healing configurations
- Standalone or combined operation

Applications

- Stadiums
- Auditoriums
- Arenas
- Civic centers
- Performing arts centers
- Theaters
- Courts of law
- Houses of worship
- Campus buildings
- Theme parks
- Hotel meeting rooms
- Conference centers
- Schools
- Cruise ships
- Teleconferencing
- Distance learning
- Large-scale paging
- Multi-purpose facilities
- Retail
- Restaurants & bars
- Gaming
- Institutional paging
- Communications
- Correctional facilities
- Professional complexes
- Residential.

Cards

NIO-4x4

- Four analog mic/line level audio input channels
- Four analog line level audio output channels
- 24 bit A/D (inputs), 24 bit D/A (outputs)
- 48 or 96 kHz audio sampling rate supported
- High reliability DIN connector to backplane, using slide rail for alignment
- Mini-Euro connectors for easy input connection.

This type of card can be installed in any of the available expansion slots at the rear of the NION.

NIO-8ml II

- Eight analog mic/line level audio input channels
- 24 bit A/D (inputs)
- 48 or 96 kHz audio sampling rate supported
- High reliability DIN connector to backplane, using slide rail for alignment
- Mini-Euro connectors for easy input connection.

This type of card can be installed in any of the available expansion slots at the rear of the NION.

NIO-8i

- Eight analog line level audio input channels
- 24 bit A/D (inputs)
- 48 or 96 kHz audio sampling rate supported
- High reliability DIN connector to backplane, using slide rail for alignment
- Mini-Euro connectors for easy input connection.

This type of card can be installed in any of the available expansion slots at the rear of the NION.

NIO-8o

- Eight analog line level audio output channels
- 24 bit A/D (outputs)
- 48 or 96 kHz audio sampling rate supported
- High reliability DIN connector to backplane, using slide rail for alignment
- Mini-Euro connectors for easy input connection.

This type of card can be installed in any of the available expansion slots at the rear of the NION.

NIO-AEC

- Eight analog mic/line-level audio input channels with 24 bit A/D
- Eight channels of wideband acoustic echo cancellation

- Acoustic echo cancellation can be applied to mic input or internal audio input channels (from NION)
- 48 or 96 kHz audio sampling rate supported
- High reliability DIN connector to backplane, using slide rail for alignment
- Mini-Euro connectors for easy input connection.

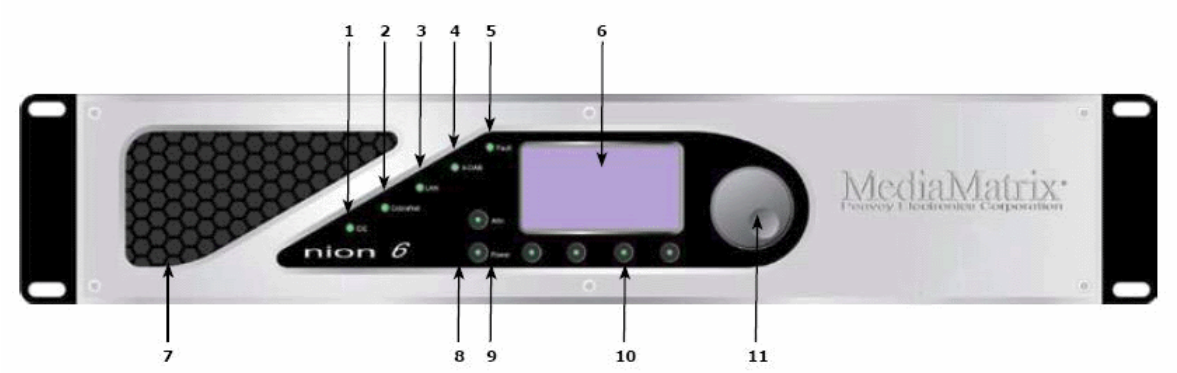
This type of card can be installed in any of the available expansion slots at the rear of the NION.

NIO-AES

- Eight channel pairs of AES3 input or output audio channels
- Input or output channel pairs may be selected individually in software
- S/PDIF supported and enabled with onboard dip switches
- Sample rate converters defeatable in the NWare control software
- 48 or 96 kHz audio sampling rate supported
- High reliability DIN connector to backplane, using slide rail for alignment
- Mini-Euro connectors for easy input connection.

This type of card can be installed in any of the available expansion slots at the rear of the NION.

Front Panel



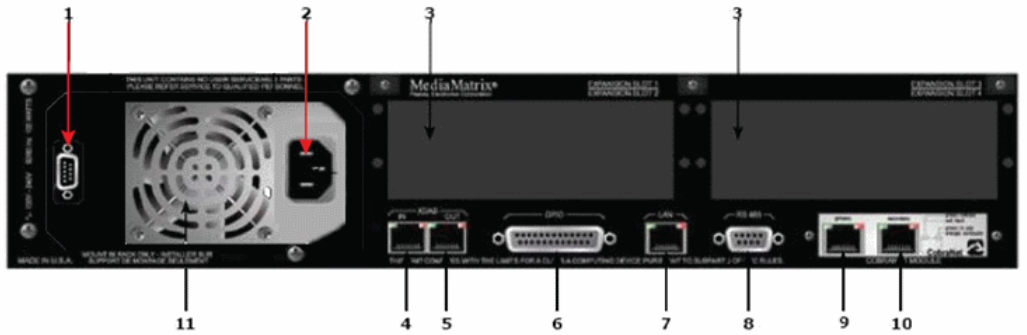
1. **IDE** Single-color LED indicates activity to/from the internal IDE storage media.
2. **CobraNet** Single-color LED indicates activity to/from the internal CobraNet audio transport.
3. **LAN** Single-color LED indicates activity to/from the Ethernet network interface.
4. **XDAB** Single-color LED indicates activity to/from the XDAB audio expansion bus. (NION n3, n6 only.)
5. **Fault** Single-color LED indicates muted audio condition.
6. **LCD Display** Backlit graphical display provides access to system hardware monitoring, configuration and status functionality. (NION n3, n6 and nX only.)
7. **Air Vent** Air intake vent provides fresh air flow to internal cooling system.

   Do not block or obstruct this vent. Proper airflow must be maintained for proper operation.
8. **ATTN** Button includes a red LED that flashes when user response is required.

   Upon pressing, LCD will then jump directly to the LCD screen that will show the error. (NION n3, n6 and nX only.)
9. **Power** Button will start the boot up process when in standby mode. When the unit is running, the button will cause the LCD screen to jump directly to the Power menu, where you can choose to Power Down or Reboot.

   Note: There is an intentional delay after powering off and before the Power button will turn on the unit. This is meant to protect the circuitry by allowing voltages to fully discharge. The integrated LED will not illuminate.
10. **Soft Buttons (4)**. Momentary buttons used in conjunction with the LCD display allow user input and navigation of hardware functionality. The function of each button is indicated on the display text of the LCD display graphic nearest the corresponding button. The integrated LEDs will not illuminate. (NION n3, n6 and nX only.)
11. **Data Wheel** Continuous action rotary encoder and embedded push-button provide navigation and data entry functionality in conjunction with the LCD display. The function of these controls is dependent on the active function of the LCD display. (NION n3, n6 and nX only.)

Rear panel



1. **Serial Port** Female DB-9 panel connector, which provides RS-232 communications for external control protocols.

   Note: On earlier units, this connector is on the front panel.

2. **Power Receptacle** Flush-mount IEC power receptacle for connecting a compatible IEC power cable (included).

   Use only the supplied cable or an equivalent international version.

3. **Module Bays** Housing bays for NION series expansion cards. Up to 4 Nio series I/O cards can be installed in a NION n3 or NION n6. Up to 2 Nio series I/O cards can be installed in a NION nX.
4. **XDAB In** RJ-45 panel connector accepts a shielded CAT6 data cable for transport of the proprietary NION digital audio input bus. (NION n3, n6 only.)
5. **XDAB Out** RJ-45 panel connector accepts a shielded CAT6 data cable for transport of the proprietary NION digital audio output bus. (NION n3, n6 only.)
6. **GPIO** Female DB-25 panel connector provides access to the internal GPIO control functionality.
7. **LAN** RJ-45 panel connector accepts a CAT5 data cable for data transport to/from the internal network interface. This connection is required on all units for system configuration and inter-unit communications.
8. **RS-485/422** Female DB-9 panel connector accepts a standard DB-9 connector (not included) to provide access to the external RS-485 or RS-422 external control protocols.
9. **CobraNet Primary** RJ-45 panel connector accepts a CAT5 data cable for data transport to/from the integrated CobraNet audio transport network interface.
10. **CobraNet Secondary** RJ-45 panel connector accepts a CAT5 data cable for data transport to/from the secondary integrated CobraNet audio transport network interface.

    Note: This port does not provide additional CobraNet capacity and only becomes active in the event that the network connected to the Primary CobraNet port becomes inoperative.

11. **Power Supply** Industrial ATX format power supply with exhaust fan.

    Additional air flow is provided on the side panel opposite the power supply. Install with at least 2” of free clearance on sides of unit. Do not block any air intake or

exhaust vent.

Chapter 5

Setting up the NION

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Introduction

Although there are many variables that exist for properly configuring the NION to pass audio, the most basic requirements are shown below. These basic parameters will ensure that you can connect, pass audio and control the NION processor.

Before you can get audio to pass through the NION, you will need to design your project file in the NWare software. Please refer to the NWare User Guide for more information. It is highly recommended that this process be deferred to system designers, engineers or technicians who have attended the NION Technology & Applications Factory Seminar.

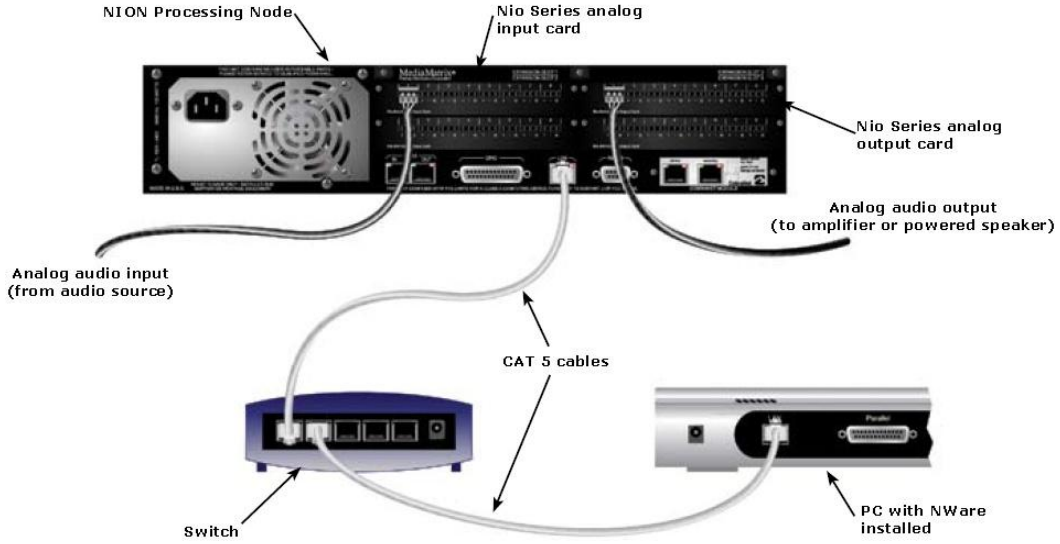
To properly configure the NION for audio operation, the following items are required or recommended:

- NION processing node
- At least one Nio series analog audio input card
- At least one Nio series analog audio output card

Tip: The nio-4x4 card supports both analog audio inputs and outputs on the same card. This card can be used in place of an input card and an output card.

- A late model computer running Windows 2000/XP/Vista
- NWare software
- Properly configured NWare project file
- One Ethernet 100Base/TX network switch
- At least two CAT5 cables
- Audio source
- Powered loudspeaker
- Audio cabling.

For the purposes of testing and establishing basic operation, configure the NION as a stand-alone processor. Typical connections for this configuration are shown in the illustration.


NION Processing Node
Nio Series analog input card
Nio Series analog output card
Analog audio output (to amplifier or powered speaker)
Analog audio input (from audio source)
CAT 5 cables
Switch
PC with NWare installed

Configuration

When you have established typical connections and are ready to load your NWare project file, you should firstly configure the NION's basic operational parameters. Certain functions, such as communications, may not function correctly until properly configured. The configuration process can be completed using the NION front panel interface or the web interface.

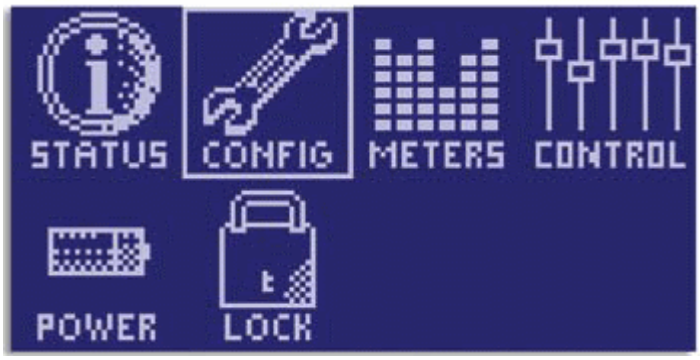
Note: If you are using a NION nE, you must use the web interface.

The front panel interface

The front panel interface includes an LCD display, four context-sensitive soft buttons, two fixed function buttons and a data wheel with integrated push button. Basic navigation is accomplished with the soft buttons and the wheel, while the wheel's push button is used to select and confirm settings. Each section of the NION interface includes several pages. Each page is accessible in sequence, controlled by **PREV** and **NEXT** soft buttons. To complete an entry use the **OK** soft button. To cancel out completely, use the **CANCEL** soft button. Once a page is selected, the wheel and wheel push button will provide the navigation.

The cursor type indicates the action and position. An outlined cursor indicates the current cursor position. A solid filled cursor indicates a selection. Once a cursor position is selected, the wheel provides the ability to change the value at the current position. Pressing the wheel button again returns the cursor to position status.

The sections that follow describe how to change settings in the **CONFIG** menu. This menu is available from the **Home** page.



Tip: If you are viewing a different screen, you can select the **HOME** option to return to the home page.

Note: If security has been enabled, you will need to specify a password before you can change any of the settings.

Updating the firmware

Firmware on NIONs is managed centrally using NWare. For information on updating firmware, see *Updating firmware on MediaMatrix devices* in the *NWare User Guide*.

Using the front panel

Specifying a name

Each NION has a name that is displayed in the web interface, on the front panel (if fitted) and in NWare and Dante Controller.

In the factory, an identical name is given to every NION. Therefore, in order to identify individual units by their names, you must assign a unique name to each unit. If you are using Dante, this is particularly important, as Dante transmitters and receivers in Dante Controller are identified by the names assigned to the NIONs.

To specify a name

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**.

2. Turn the data wheel clockwise.

   The first letter of the NION name will be highlighted.
3. Use the data wheel to specify a unique name for the NION.
4. Press **OK**.

   The **POWER** screen is displayed.
5. In the **ACTION** list, select **POWER DOWN**.
6. Wait 30 seconds and then power up the NION.

   This delay allows time for entries in the ARP cache to time out, so the new name you have specified will be used.

Setting the IP address

DHCP versus static IP

Notes:

- Care should be taken when choosing to use Dynamic Host Configuration Protocol (DHCP), rather than a static IP address. DHCP mode is provided as a convenience when using units in informal settings or for test purposes. A static IP address should always be used when units are deployed in end-user installations. DHCP-obtained IP addresses depend on a *lease* to be maintained by the DHCP server in order to keep an assigned IP address. If the IP address lease is allowed to expire, there is a chance that the IP address assigned to one or more units could be lost, changed or reassigned, resulting in the loss of control or audio from a project.
- The network administrator should be able to give you a range of static (or fixed) IP addresses to use for your project. When requesting these IP addresses, be sure to obtain enough to cover each unit.

Using DHCP to assign an IP address automatically

1. Confirm that the network to which you are connecting the unit has a DHCP server.

   Notes:

   - If DHCP mode is selected, but there is no DHCP server on the network, the unit will be unable to communicate with other devices.
   - In this example, the DHCP server is provided by the router. Ensure that your network is using a router. A plain switch will not provide the required DHCP server for the example.

2. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**.

3. Move the cursor to the second line, next to **IP**.
4. Push the wheel button, then move the wheel until the cursor position indicates **DHCP**, then push the wheel button again to confirm the settings.

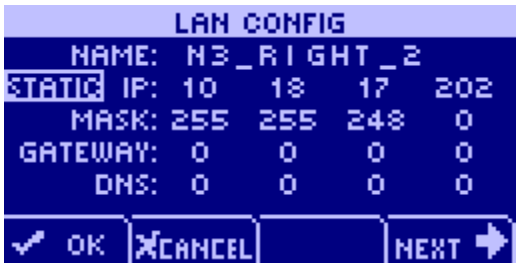
Tips:

- Since we are using DHCP, we do not need to specify an IP address, subnet mask or gateway - they are automatically assigned by the DHCP process.
- If a DNS is set up on the network and DHCP has been configured to contact the DNS, the **DNS** field will be populated automatically with the IP address of the DNS. NION uses the DNS to resolve the domain names of time servers. For more information, see Setting up a NION as a master.

5. Select **NEXT** to advance to the next page, or **OK** to confirm the settings and exit.
   To abort the process, select **CANCEL**.

Using a static IP address

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**.



2. Move the cursor to the second line, next to **IP**.
3. Push the wheel button, then move the wheel until the cursor position indicates **STATIC IP**, then push the wheel button again to confirm the settings.
4. Use the wheel and wheel button to specify an IP address.

Note: The IP address must be unique on the network to avoid conflicts.

5. Set **MASK** to the network mask for your network.
6. If your subnet is connected to a router and this NioNode will be connecting to devices across the router, set **GATEWAY** to the router's IP address.
   If you have no router, set **GATEWAY** to 0.0.0.0.

Tip: The **DNS** field is used for contacting a DNS on the network, which in turn is used to resolve domain names of time servers. For more information, see *Setting the time and date* (on page 37).

7. Select **NEXT** to advance to the next page, or **OK** to confirm the settings and exit.
   To abort the process, select **CANCEL**.

Specifying the CobraNet settings

CobraNet is an important component of system design with NION products. In order to ensure proper operation of the CobraNet audio transport, several variables must considered.

The NION is shipped with a default CM-1 setting of 0.0.0.0, which means that the IP will be set only when the CobraNet Discovery application assigns it. For any other use of TCP/IP with a CM-1, you must configure the IP address and mask.

For typical audio transport, it is generally not necessary to configure the CobraNet node with an IP address. However, because the CM-1 supports SNMP, configuration of the IP address and mask may be required.

To specify the CobraNet settings

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **CM-1 NETWORK CONFIG** page is displayed.
2. For DHCP operation, use the wheel and the wheel push button to set the IP address to `0 0 0 0` and the mask to `255 255 255 0`.

   For fixed IP operation, use the same process to configure the IP address and mask as required by your network.

3. Select **NEXT** to advance to the next page, or **OK** to confirm the settings and exit.

   To abort the process, select **CANCEL**.

Setting up the network services

Introduction to network services

Web

The NION processor includes a built-in web server that provides access to several key hardware functions from any web browser. For more information about web services, please see the NWare help file.

Telnet

Telnet is a communications protocol that provides access to the Linux system kernel on the NioNode.

Note: For security reasons, you should only enable the Telnet function when asked to by MediaMatrix Technical Support. Once you have finished communicating with the NION, you should disable the Telnet function. Telnet is not required for communications with the NWare software or for using RATC.

SNMP

Simple Network Management Protocol is a network protocol that provides robust monitoring and control of system parameters across the network. Using SNMP, you can utilize a host of standard software tools and third-party systems to extend the control and monitoring power of the NION for a wide variety of applications.

Enabling or disabling services

The **NETWORK SERVICES** page provides access to global network services. Each control is a two-state control where the service is either on (**ENABLED**) or off (**DISABLED**).

To enable or disable services

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **NETWORK SERVICES** page is displayed.

2. Use the wheel and wheel push button to enable or disable each service as required.
3. When you are satisfied with the services settings, select **APPLY** and press the wheel button to complete the adjustment.

Configuring security

You can prevent users from controlling the NION via the front panel by enabling security and then selecting the **LOCK** option from the main menu.

When security is enabled, the user must enter a four digit numeric password (called a *combination*) before they can access any settings.

Caution: The **FRONT PANEL COMBO** feature will secure the NION from front panel access. A lost combination cannot be retrieved and there is no *back door*. If the combination is lost, the NION must be reset to a virgin state, thereby discarding any resident audio configuration files. Use the **FRONT PANEL COMBO** and **LOCK** features with care.

Enabling security

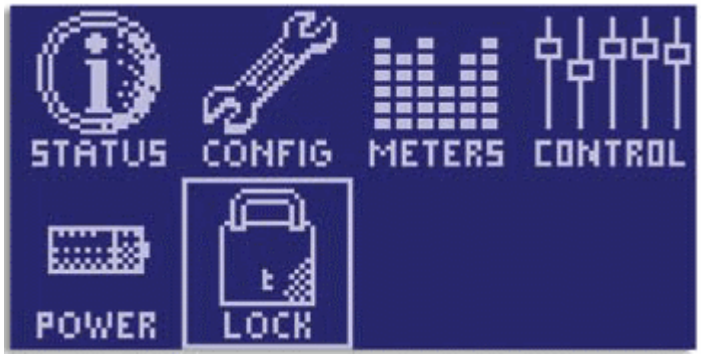
1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **FRONTPANEL COMBO** page is displayed.

2. Using the wheel and the wheel push button, move the cursor to each **NEW COMBO** field and select a number to specify the new combination.

3. Move the selection to **APPLY** and press the wheel push button.

Locking the front panel

1. From the main menu, move the cursor to the **LOCK** icon and use the wheel push button to enter the **LOCK** screen.



2. Use the wheel and the wheel push button to enter the combination.

3. Move the cursor to **LOCK** and push the wheel's push button to engage security, or select **CANCEL** to abort the process.

Caution: Once the front panel is locked, it will not be possible to use the functions of the NION until the correct combination has been entered. There is no *back door*.

Disabling security

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **FRONTPANEL COMBO** page is displayed.
2. Using the wheel and the wheel push button, move the cursor to each **OLD COMBO** field and select a number to specify the current combination.
3. Move the cursor to each **NEW COMBO** field and select `0 0 0 0` as the new combination.

4. Move the selection to **APPLY** and press the wheel push button.
5. Select **HOME** to return to the main page.

Changing the security combination

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **FRONTPANEL COMBO** page is displayed.
2. Using the wheel and the wheel push button, move the cursor to each **OLD COMBO** field and select a number to specify the current combination.
3. Move the cursor to each **NEW COMBO** field and select a number to specify the new combination.

4. Move the selection to **APPLY** and press the wheel push button.

Enabling or disabling the web interface

The web interface is disabled by default on NioNodes and must be enabled before you can access a NION via a web browser.

To enable or disable the web interface

1. Open a browser and specify the IP address of the NION in the **Address** bar.
2. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **NETWORK SERVICES** page is displayed.

3. Use the wheel and the wheel push button to change the **WEB** setting to **ENABLED** or **DISABLED**.
4. Select **APPLY**.

When the web interface is enabled, you can enter the IP address of the unit into your web browser to get to the web interface.

Tip: If this does not work, you may have an IP address problem on either the NioNode or your PC. If you have a proxy server set up in your internet options, you may have to create an exception for local IP addresses.

Understanding the system status page on the front panel

The system status page on the NION front panel shows information about the CPU load during set periods of time. The information is based on the output from the Linux *Top* command, */proc/loadavg* file and the *uptime* command.

LOAD	The average of the number of tasks running during the period of time since the page was last refreshed.
5M	Average CPU load over the last 5 minutes.
15M	Average CPU load over the last 15 minutes.
CPU	Current percentage utilization of the CPU.

For more information on the *Top* command, see *http://linux.die.net/man/1/top* (*http://linux.die.net/man/1/top*).

For more information on the */proc/loadavg* file and the *uptime* command, see to *www.luci.org* (*http://www.luci.org/luci-discuss/200210/msg00055.html*).

Adjusting the LCD backlight intensity and viewing angle

The **LCD CONFIG** page allows you to adjust the LCD backlight intensity and the viewing angle.

The perceived contrast is dependent on the viewing position. For example, a setting that provides high contrast when viewing the display from the front, may provide an inverted view when looking at the display from above. Adjust for the best view at the common working angle.

To adjust the LCD backlight intensity and viewing angle

1. From the main menu, select **CONFIG** to display the first configuration page, **LAN CONFIG**, then select **NEXT** repeatedly until the **LCD CONFIG** page is displayed.
2. Use the wheel and push button to select **LCD BACKLIGHT**.

3. Use the wheel's rotary control to select the desired value.

   The range is 0 (least intense) to 15 (most intense).
4. Use the wheel and push button to select **VIEWING ANGLE**.
5. Use the wheel's rotary control to select the desired value.

   The range is 10 to 40 with the 20 position providing the highest contrast and color when viewing the display *head on* or directly in front.
6. When you are satisfied with the display settings, select **NEXT** to advance or **HOME** to complete the adjustment.

Using the web interface

Specifying a name

Each NION has a name that is displayed in the web interface, on the front panel (if fitted) and in NWare and Dante Controller.

In the factory, an identical name is given to every NION. Therefore, in order to identify individual units by their names, you must assign a unique name to each unit. If you are using Dante, this is particularly important, as Dante transmitters and receivers in Dante Controller are identified by the names assigned to the NIONs.

To specify a name

1. Navigate to the **Network** screen.
2. Under **Host Name Configuration** in the **Host Name** box, type a unique name for the NION.
3. Click **Set** to confirm the action.

   You will be asked to log on.
4. Specify your username and password. The default username is *superuser*; it has no password.
5. Navigate to the **Special** screen.
6. Under **Unit Shutdown**, in the action box, click **power down**.
7. Click **Do it**.
8. Wait 30 seconds and then power up the NION.

   This delay allows time for entries in the ARP cache to time out, so the new name you have specified will be used.

Setting the time and date

Introduction

For accurate reporting of events when running different MediaMatrix units, it is critical to specify the proper time zone, time, and date settings. Correct settings will ensure that the event logs and other time sensitive information are accurately recorded and displayed.

There is a time synchronization system that ensures that the time and date settings on NIONs, nControl units and nTouch 180 units are the same across the network. If you change the date on a NION, for example, it is automatically changed on the other devices. This feature is especially useful for debugging. If you look at an event in the log that occurred at a particular time on one NION, you can be sure that an event with the same timestamp on a different NION occurred at exactly the same time.

You can specify the time and date settings manually, or they can be obtained automatically from a time server.

Tip: A time server can be set up on your local network, or you can connect to one via the internet. For information on available internet time servers, see *http://www.pool.ntp.org* (*http://www.pool.ntp.org*).

Synchronization modes

Mode name	Description
Normal	If you specify Normal mode for all units on the network, so no Master node is available, when you specify time and date settings on any of the units, they will be assigned to the others automatically. If a unit on the network is using Time Server or Master mode, all units in Normal mode will be assigned time and date settings from that unit – they will act as *slaves*.
Master	The time and date settings from this unit will be assigned to all units that are using Normal mode.
Time Server	This node will contact a time server to retrieve time and date settings. The time and date settings from this unit will be assigned to all units that are using Normal mode. The time server can be contacted using its IP address or a domain name. **Note:** When you use a domain name, it must be resolved to an IP address. This is done automatically, but you must specify DNS or DHCP settings on the Network screen in the web interface.

Setting up synchronization

Scenario	Actions to take
You want to be able to set the time and date on *any* MediaMatrix node on the network manually, and for the settings to then be automatically assigned to the others.	On all MediaMatrix nodes: 1. Navigate to the **Time and Timezone** tab. 2. Clear the **Time Server** box. 3. In the **Authority** list, click **normal**. 4. Click **Set**. If you want to adjust the time and date, perform these steps on any MediaMatrix node: 1. In the **Time (24hr)** box, type the new time in the format HH:MM:SS. 2. In the **Date (mm/dd/yy)** box, type the new date in the format mm/dd/yy. 3. Under the **Date (mm/dd/yy)** box, click **Set**. 4. If you are using a NION, under **Timezone**,

Scenario	Actions to take
	specify a continent and country. 5. If the country has more than one time zone, in the **Zone** list, click the time zone. **Tip:** Where a country has only one time zone, you do not need to make a selection. 6. Under the **Zone** box, click **Set**.
You want the time and date for all nodes on the network to be obtained automatically from a single, master unit. You do not want anyone to be able to assign times and dates to the other units by accessing them directly. You will specify the time manually.	On the master node: 1. Navigate to the **Time and Timezone** tab. 2. Clear the **Time Server** box. 3. In the **Authority** list, click **Master**. 4. Click **Set**. If you want to adjust the time and date, perform these steps on the master node: 1. In the **Time (24hr)** box, type the new time in the format HH:MM:SS. 2. In the **Date (mm/dd/yy)** box, type the new date in the format mm/dd/yy. 3. Under the **Date (mm/dd/yy)** box, click **Set**. 4. If you are using a NION, under **Timezone**, specify a continent and country. 5. If the country has more than one time zone, in the **Zone** list, click the time zone. **Tip:** Where a country has only one time zone, you do not need to make a selection. 6. Under the **Zone** box, click **Set**. On the other (slave) nodes: 1. Navigate to the **Time and Timezone** tab. 2. Clear the **Time Server** box. 3. In the **Authority** list, click **normal**. 4. Click **Set**. **Note:** If you try to change the time and date settings on the slave nodes, they will automatically change to match the settings on the master node.

Scenario	Actions to take
You want the time and date for all nodes on the network to be obtained automatically from a time server.	On the master (time server) node: 1. Navigate to the **Time and Timezone** tab. 2. In the **Time Server** box, type IP address or domain name of a time server. **Note:** If you are using a domain name to contact the time server, a DNS must be present on the network. If a DHCP server is not available on the network, you must specify the IP address of the DNS on the Network page for the local area connection you are using. 3. In the **Authority** list, click **time server**. 4. Click **Set**. **Note:** Once you select time server mode, you will not be able to change the time or date settings. On the other (slave) nodes: 1. Navigate to the **Time and Timezone** tab. 2. Clear the **Time Server** box. 3. In the **Authority** list, click **normal**. 4. Click **Set**. **Note:** If you try to change the time and date settings on the slave nodes, they will automatically change to match the settings on the time server node.

Specifying the IP address via the web browser

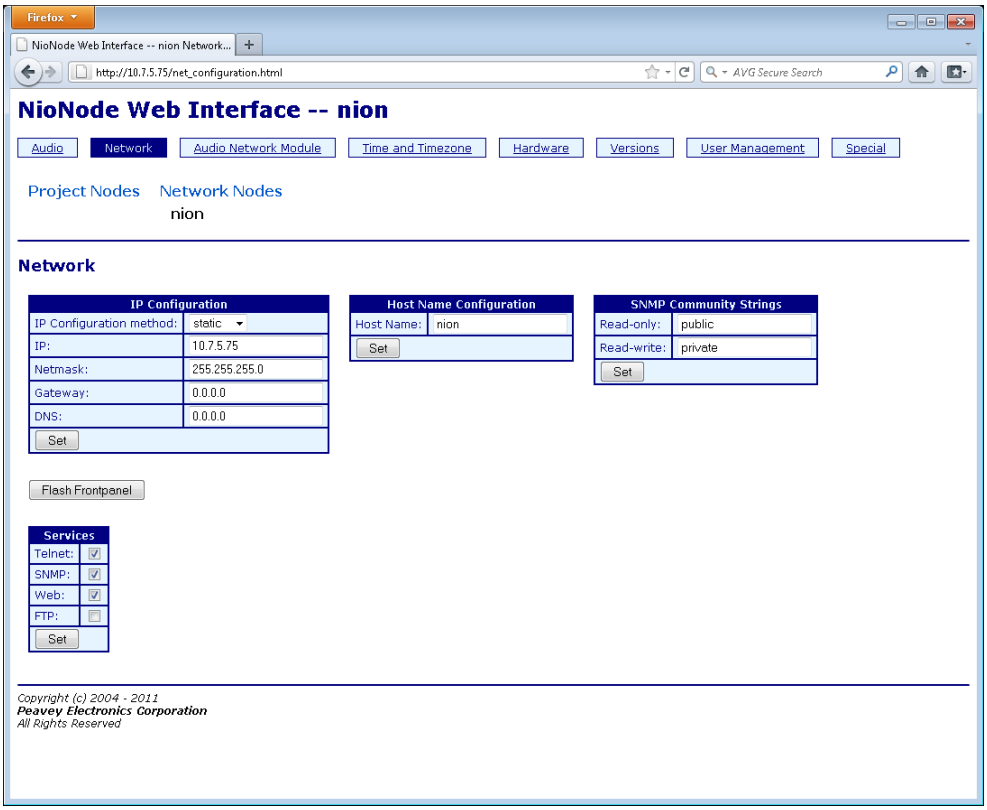
1. Open the Windows network settings.
   For Windows 7:
   a) On the **Start** menu, click **Computer**.
   b) Right-click **Network**, and then click **Properties**.
   c) Click **Change Adapter Settings** and then select the network you wish to edit.
   For Windows XP:
   a) On the **Start** menu, click **My Network Places**.
   b) Click **View Network Connections**.

1. Configure the PC with an IP address in the same subnet as is noted on the while sticker on the back of the NION. For example, if the sticker shows 10.7.5.75, then your computer's IP address will be 10.7.5.X where x is any value below 75, such as 10.7.5.66.
2. Set the subnet mask to 255.255.255.0.
3. Connect the PC to the NION using an Ethernet switch or crossover cable.
4. Open a web browser and enter the NION default IP address (see white sticker) into the web address bar.
5. Click the **Network** tab.

   If a different static IP address is required then:

   a) Make sure that static is selected in the **IP Configuration Method** list.

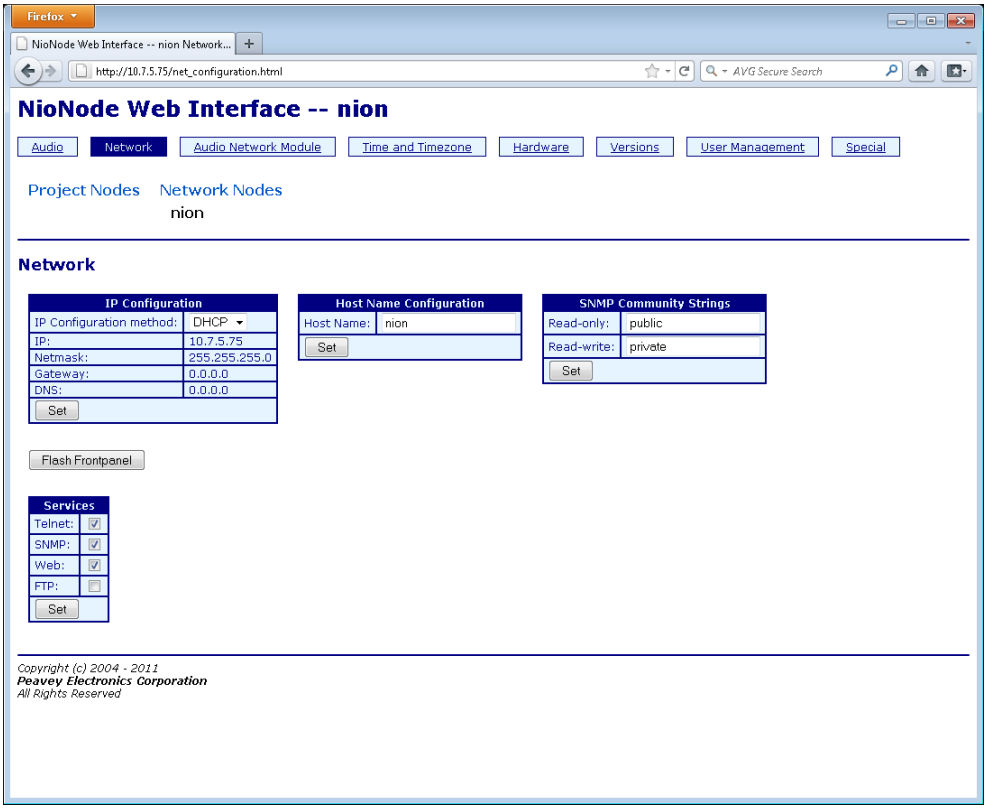
   b) Fill in IP address and netmask value appropriate to your network. The Gateway and DNS entries can also be entered if required.



Note: To change settings on the web interface a user name and password is needed. The default username is *superuser*; it has no password.

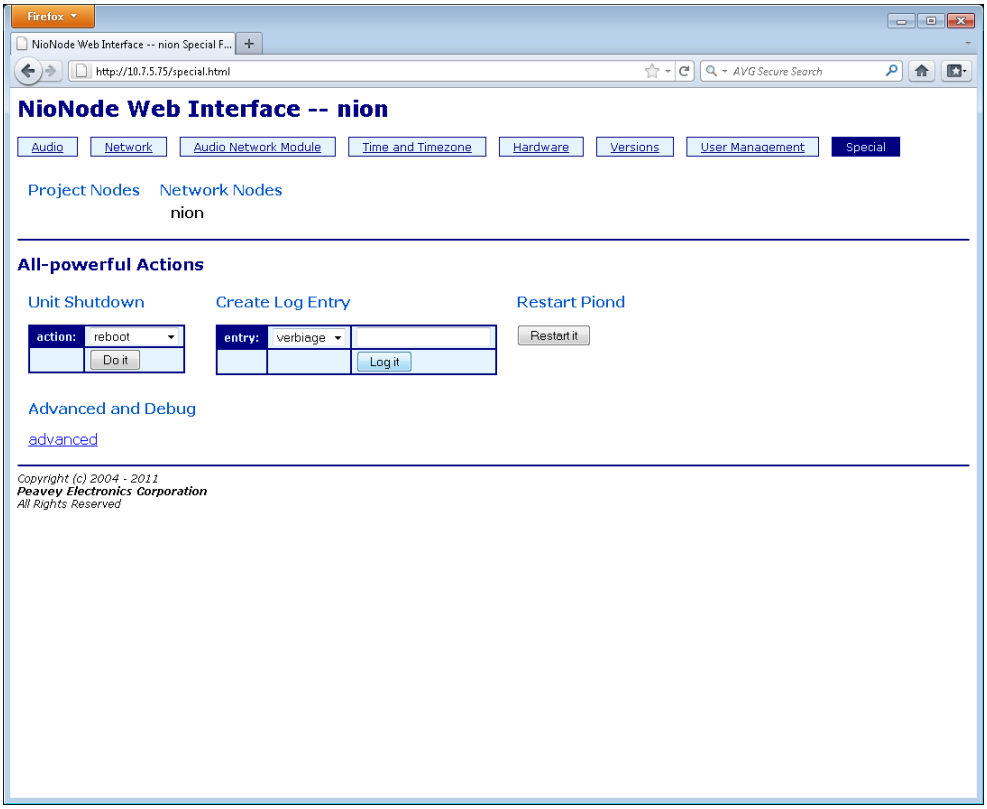
If DHCP is required for set-up purposes, select DHCP in the **IP Configuration Method** list.

Note: Care should be taken when choosing DHCP rather than static. DHCP mode is provided on the NION machine as a convenience when using NioNodes in informal settings, such as when you are experimenting. Static IP addresses should always be used when NioNodes are deployed in *production* systems. DHCP-obtained IP addresses depend on a *lease* to be maintained by the DHCP server in order to keep an assigned IP address. If the IP address is allowed to expire there is a chance that the IP address assigned to one or mode NioNodes could be lost, changes or reassigned, resulting in the lost of control audio from a NION project.



6. Once the network configuration page has been completed, reboot the NION:
   a) Click the **Special** tab.

b) In the **action** list , click **reboot** and then click **do it**.



c) Once the NION has rebooted, enter the NION new IP address into the web browser.

Copying media files to the NION

You can copy media files over to the NION using FTP and then use them in your NWare projects. This allows you to quickly change the available media in a project. You can also minimize the size of the NWare project file by storing your media on the NION and not in the project file itself. You can use any FTP client to copy the files.

In order to allow files to be copied, you need to enable the FTP server on the node you are using. This is done via the web interface. Once FTP is enabled, you can use an FTP client (or the FTP command from a Command Prompt window) to copy files over.

Files on an nControl unit can be played using a Media Player device in your NWare design.

Files on a NION can be played using a Wave File Player device in your NWare design.

For more information on these devices, refer to the *NWare Device Reference*.

Notes:

- It is not currently possible to view the amount of available space for storing media files.
- When the project is deployed, media files must be located on the same node that hosts the NWare device playing the files. If the files are located on a different node, you will not be able to play them. We recommend that you manually assign the device playing the files to a role and deploy that role to the node that will host the media files.
- You can disable the FTP server by clearing the FTP check box (see procedure below), but if you are using an nControl unit or nTouch 180 unit, you must restart it before the change will take effect.

To enable the FTP server

1. Navigate to the **Network** screen.
2. Under **Services**, select the **FTP** check box.
3. Click **Set** to confirm the action.

   You will be asked to log on.
4. Specify your username and password. The default username is *superuser*; it has no password.

To copy media files to the NION

1. Open a Command Prompt window.
2. Navigate to the folder containing the media files.
3. Type `FTP` and press Enter.

   The `ftp>` prompt is displayed.
4. Type `open <IP address of NION>` and press Enter.

   The following message is displayed.

   ```
   Connected to <IP address>.
   ...
   User (<IP address>:(none)):
   ```
5. Type `anonymous` and press Enter.
6. If you are prompted for a password, press Enter.

   You do not need to specify a password.
7. If you want to list the files already copied to the unit, type `ls` and press Enter.
8. Type `binary` to switch to binary copy mode.
9. Type `mput <filename>` and press Enter.

   The parameter <filename> is either a single file or a wildcard referencing multiple files.

When you have finished copying files, type `quit` to close the ftp session.

Managing users

Introduction

Users are created via the web interface, and assigned privileges to allow them to perform certain operations, as listed below.

Privilege	What it controls
Deploy	Determines whether the user can deploy a role to this node.
Update Firmware	Determines whether the user can update the firmware on this node.
Debug Menu Access	Determines whether the user can access the debug menu of this node using the Pandebug application.
User Administration	Determines whether the user can create, edit and remove user accounts on this node.
NioNode Administration Access	Determines whether the user can change settings such as network configuration and time and date.
Log Access	Determines whether the user can view or clear the log. **Tip:** For more information on viewing the log within NWare, see *Remote Log* in the *NWare User Guide*.

There are two default users: *superuser* and *defaultuser*, which cannot be deleted. You can add your own users as necessary.

superuser	Has all privileges enabled. None of its settings can be changed, apart from the password, which is blank by default.
defaultuser	Has all privileges enabled, apart from *User Administration* and *NioNode Administration Access*.

In NWare, when you perform an action that involves the node, such as deploying a role or updating firmware, NWare logs on to the node using a particular username. The node matches this username with the username of the same name stored on the unit. The privileges of the username on the node determine whether the action may be carried out.

Tip: Users often log on to nodes with the username *defaultuser*. If the settings for this username on the node show the **Deploy** privilege set to **Disallow**, it will not be possible to deploy a role to the node even when they are logged on.

Adding a new user

1. Navigate to the **User Management** screen in your web browser.
2. Click **Add new user**.
   The **Edit User** screen is displayed.
3. In the **user name** box, type the name of the new user.
4. If you want to specify a password for the user, which must be specified when the user logs on, type the password in the **Password** box, and then type the password again in the **Confirm** box.

   Note: We recommend that you always specify a password for users to ensure unauthorized persons do not gain access to the node.

5. Specify the user privileges.

Privilege	What it controls
Deploy	Determines whether the user can deploy a role to this node.
Update Firmware	Determines whether the user can update the firmware on this node.
Debug Menu Access	Determines whether the user can access the debug menu of this node using the Pandebug application.
User Administration	Determines whether the user can create, edit and remove user accounts on this node.
NioNode Administration Access	Determines whether the user can change settings such as network configuration and time and date.
Log Access	Determines whether the user can view or clear the log. **Tip:** For more information on viewing the log within NWare, see *Remote Log* in the *NWare User Guide*.

6. Click **Apply**.

Deleting a user

You can delete users from a node when they are no longer required.

Note: You cannot delete *defaultuser* or *superuser*.

To delete a user

1. Navigate to the **User Management** screen in your web browser.
2. Click the **Delete** button next to the user you want to delete.
   You will be asked to confirm the delete operation.

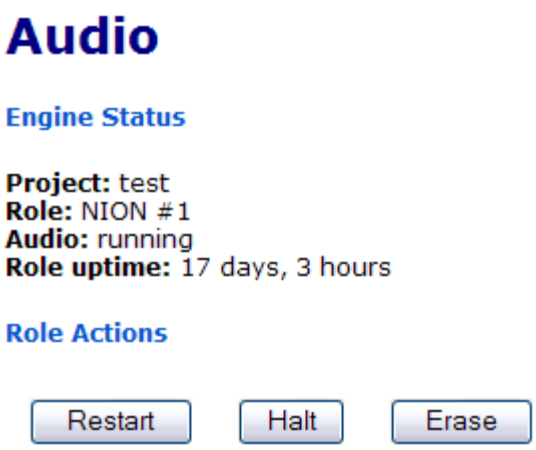
3. Click **Yes**.

Managing the role

In an NWare project, devices that are part of the design are assigned to roles, either automatically by NWare or manually by the user. Each role is then assigned to a NION, nControl unit or nTouch 180 unit for processing when the project is deployed.

Tip: Once a project has been deployed to a node, if the node is power cycled, the project is restarted automatically.

The **Audio** screen shows the NWare project to which the role belongs, the name of the role and how long it has been loaded.



Restarting the role

1. On the **Audio** screen, under **Role Actions**, click **Restart**.
2. Click **OK** to confirm the action.

Stopping the role

1. On the **Audio** screen, under **Role Actions**, click **Halt**.
2. Click **OK** to confirm the action.

Erasing the role

1. On the **Audio** screen, under **Role Actions**, click **Erase**.
2. Click **OK** to confirm the action.

Specifying the function of the RS-232 serial port

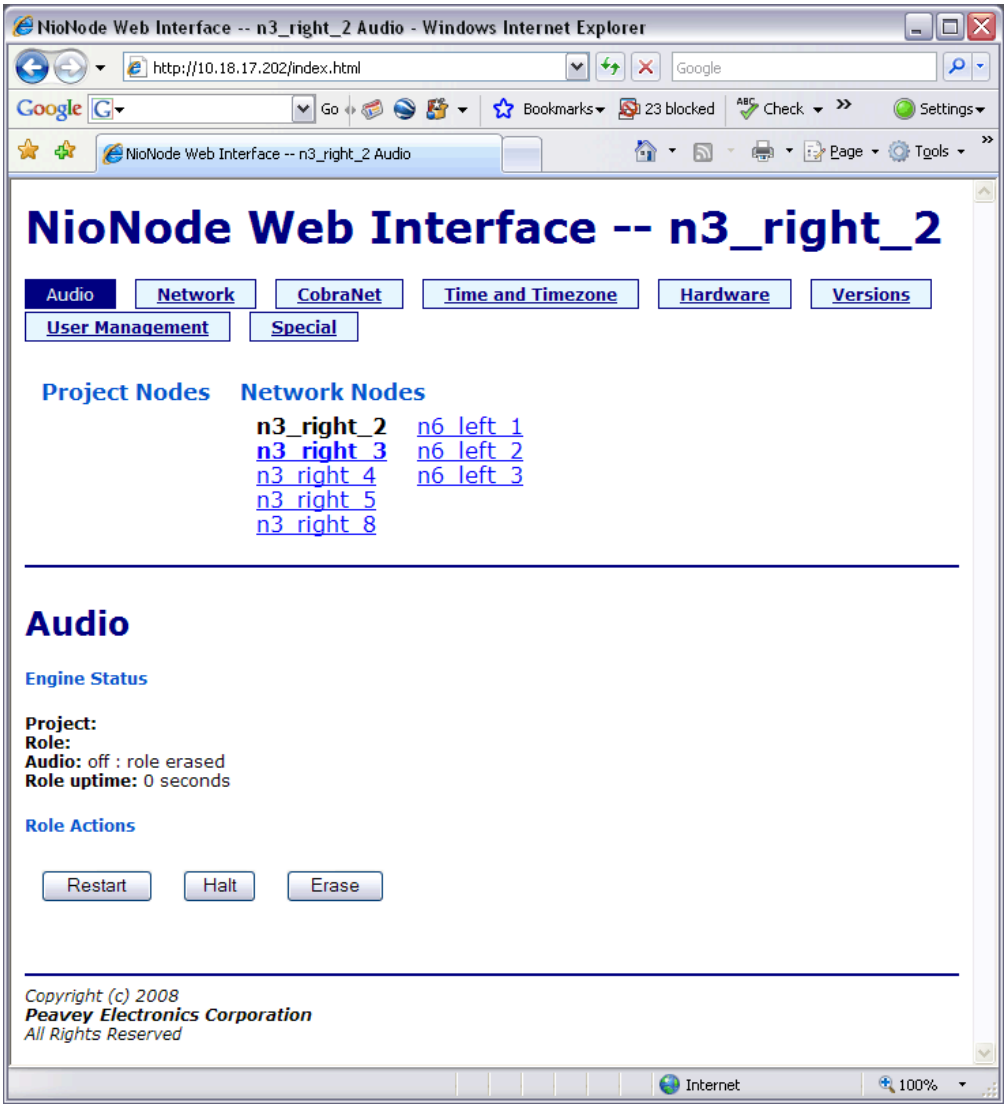
The NION RS-232 serial port performs two main functions:

- In *console* mode it allows a user to log on to the NION Linux Kernel via a serial terminal session and change the configuration settings.
- When console mode is disabled, you can control the NION using external protocols like PASHA.

By default, console mode on the RS232 serial port is disabled.

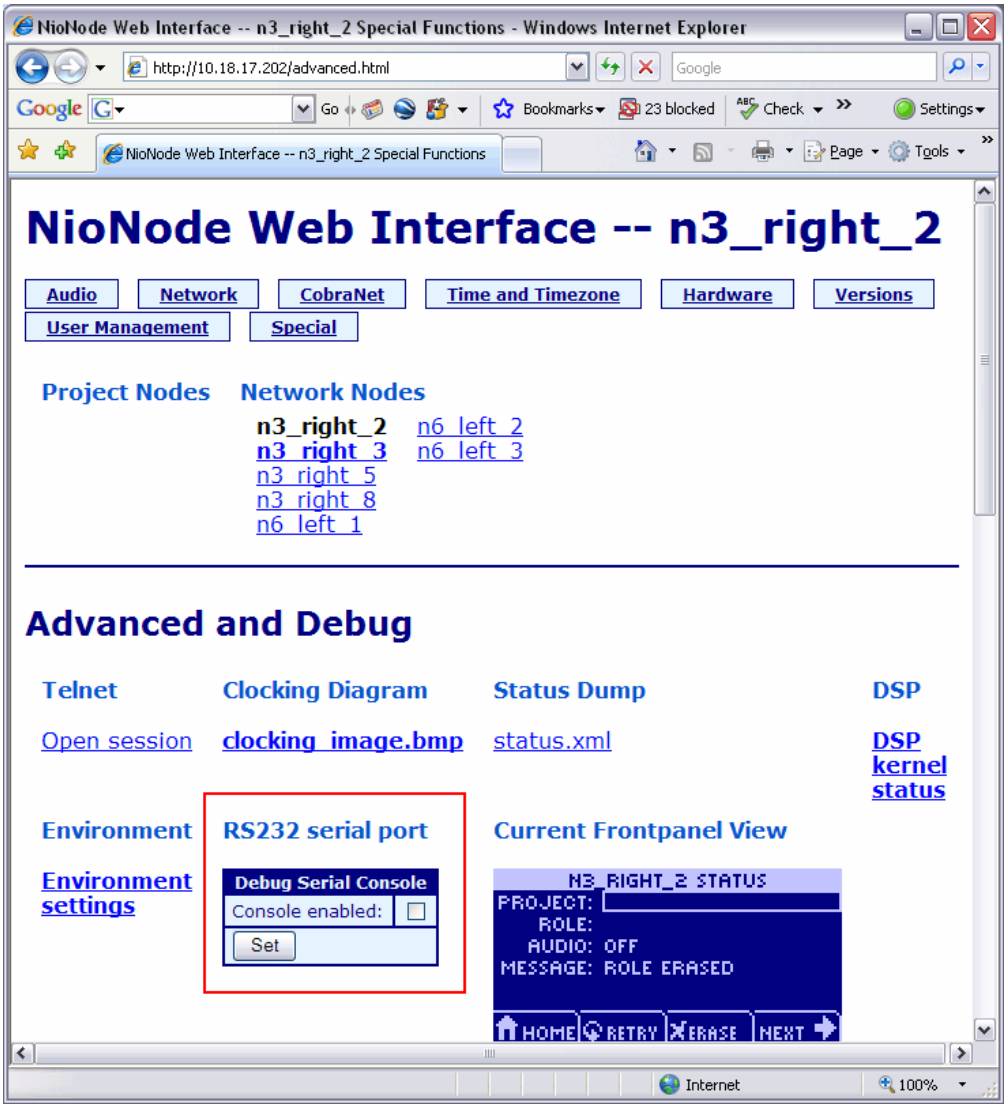
To specify the function of the RS-232 serial port

1. Open a browser window.
2. Type the IP address of the NION in the **Address** bar, and then press Enter.
   The **Audio** screen is displayed.



3. Click **Special**.
4. Click **Advanced**.

The **Advanced and Debug** screen is displayed.



5. Under **RS232 serial port**, select or clear the **Console enabled** check box.
6. Click **Set**.
   You will be asked to log on.
7. Type the username and password for the superuser.
   By default, the username is *superuser* and the password is blank.
8. Reboot the NION, so the changes take effect.

Chapter 6

Using XDAB clusters with VLANs and CobraNet

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Further examples....59

Introduction

Use of NIONs in an XDAB cluster, particularly when also using CobraNet and VLANs, creates specific considerations and rules that must be observed in order to insure proper operation of the system. This chapter is intended to provide awareness of the technical issues that must be considered when using XDAB clusters and VLANs with CobraNet. A basic knowledge of CobraNet, NIONs and VLANs is assumed.

Note: XDAB is available on NION n3 and N6 models, but not nX models.

Important concepts

XDAB cluster

NIONs connected together via XDAB are referred to as an XDAB cluster.

There is one XDAB master that provides the audio clock to all other devices in the cluster. The other devices in the cluster are XDAB slaves.

Audio clock domain

All CobraNet devices on the same network or VLAN segment must operate within the same audio clock domain. A system wide isochronous audio clock is automatically generated in a CobraNet network by the standard beat packet mechanism. A NION or CAB will always receive its audio clock from CobraNet.

Note: An exception exists for NIONs operating within an XDAB cluster:

- In the XDAB master the CobraNet clock can be taken from the CobraNet network as a CobraNet performer or the XDAB clock can be supplied as the CobraNet Conductor. Normal CobraNet clocking concepts apply.
- In XDAB slaves the CobraNet clock will always be taken from XDAB and will not be taken from the CobraNet network audio clock directly. The clock will be taken indirectly from CobraNet via the clock generated by the XDAB master.

Logical separation of the network

Use of VLANs creates a logical separation of the network that causes the VLAN segments to behave as if they are physically separate networks. Use of the term VLAN also applies to physically separate networks.

Each VLAN segment must therefore have its own CobraNet Conductor.

Multiple VLANs

Audio can be exchanged between different VLANs through the use of devices that have a network interface on each VLAN. This can be accomplished by:

- exchanging analog audio between devices. Devices connected using analog I/O do not need to be concerned with audio clocking issues between them.

or

- exchanging digital audio between devices. In this case, the audio clocks of the devices must be synchronous *or* the use of sample rate converters on the digital audio inputs is required.

Tip: The XDAB digital audio bus is the most convenient way to exchange digital audio between NIONs.

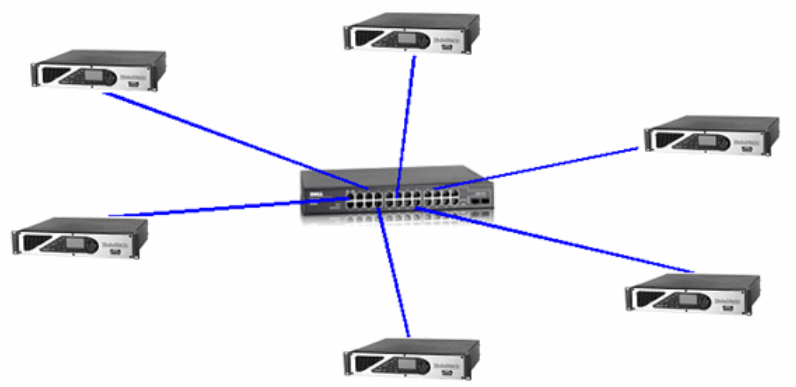
NIONs on CobraNet

Notes:

- Processing on a NION will pause during project deployment. Therefore, a NION that is a Conductor will stop being the Conductor for a time. The network will then automatically transition to a new Conductor. Conductor transitions will cause momentary audio dropouts. It may therefore be desirable to designate a non-NION device to be the CobraNet Conductor.
- Additionally, if using XDAB, clock disruption caused by a change of Conductor may often cause the NION cluster to re-sync (re-arbitrate) the XDAB clock and will result in a dropout of several seconds.

Use cases

Scenario 1 - Basic network

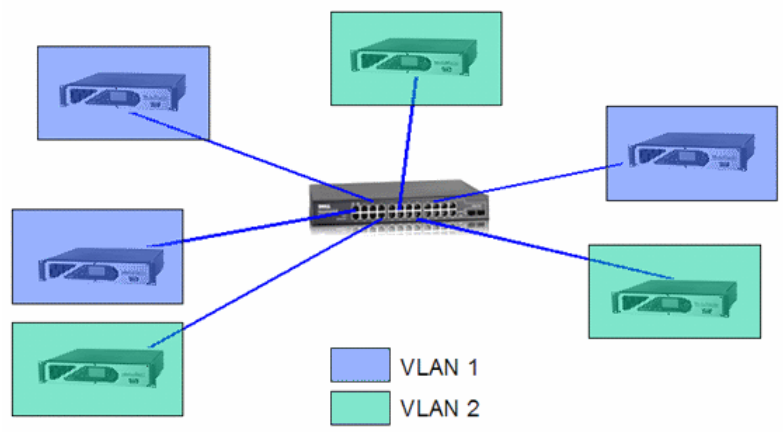


In this scenario, there are:

- no XDAB interconnections between NIONs.
- no VLANs defined.
- no outboard audio connections, either analog or digital, between NIONs.

There is only one audio clock domain in this scenario established by CobraNet and no special Conductor, topology or XDAB usage considerations apply.

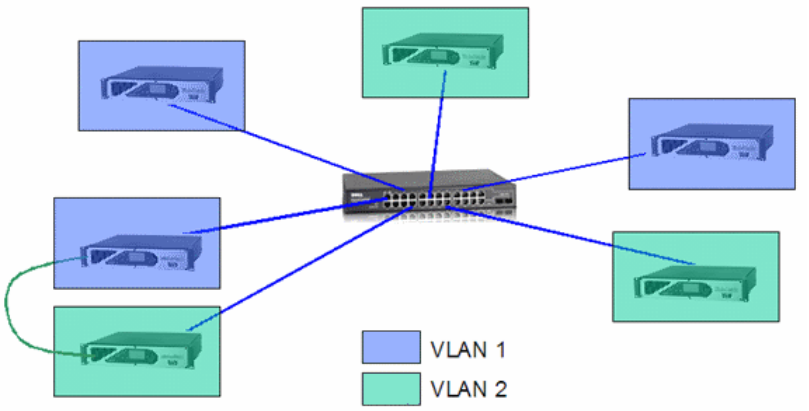
Scenario 2 - Network using VLAN



In this scenario, port based VLANs have been configured within a managed switch:

- There will be no audio passed, either externally or via CobraNet, between devices residing on different VLANs.
- Audio is only exchanged via CobraNet between NIONs that reside on the same VLAN.
- One device on each VLAN must be a CobraNet Conductor for that VLAN, i.e. each VLAN has its own Conductor.
- It is not important, logically, which devices are chosen to be Conductors. Consideration of Conductor location will only be determined when necessary, by standard network topology considerations that would apply to any CobraNet network.

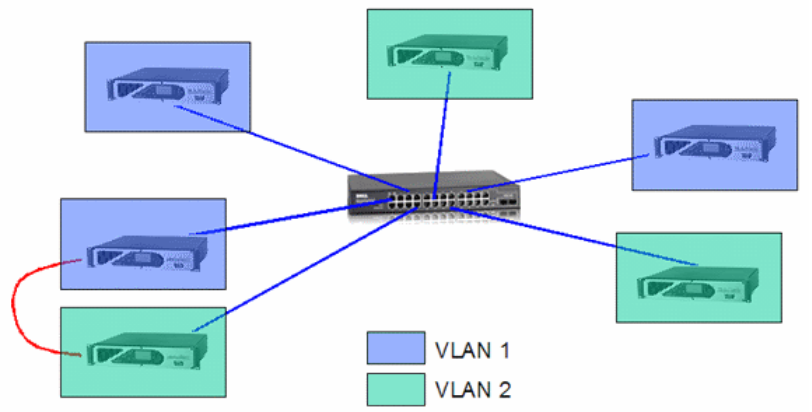
Scenario 3 - Network with VLAN and analog interconnects



In this scenario, VLANs are configured using the port based VLAN capability of a managed switch.

- Audio is bridged between the two VLANs using analog interconnects.
- The same rules for Conductors would apply as in the *previous scenario* (on page 54).
- The analog interconnect creates no digital audio clock domain issues.

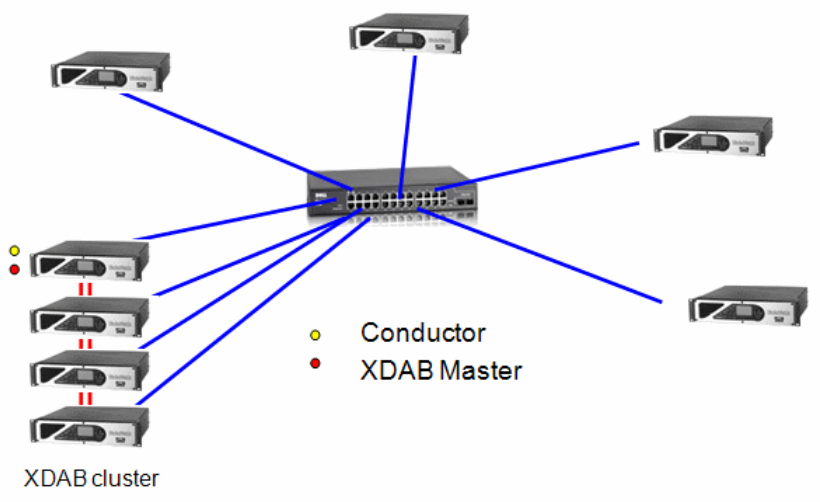
Scenario 4 - Network with VLAN and digital interconnects



This scenario is similar to the *previous scenario* (on page 54), but substitutes digital interconnects), such as AES/EBU or SPDI/F, for analog interconnects.

- NION digital interface cards contain built-in sample rate converters (SRCs), which isolate audio clock domains from each other and allow interchange of digital audio data regardless of which clock domain the transmitting and sending devices are in.
- VLAN 1 and VLAN 2 each have their own Conductor, so are in different audio clock domains.
- The SRC built into the digital interface card will allow exchange of digital audio between the NIONs in the two clock domains.
- Bypassing the SRC, which is possible, will cause errors on the AES/EBU interface.

Scenario 5 - Network with an XDAB cluster



In this scenario, digital audio is exchanged between NIONs through XDAB.

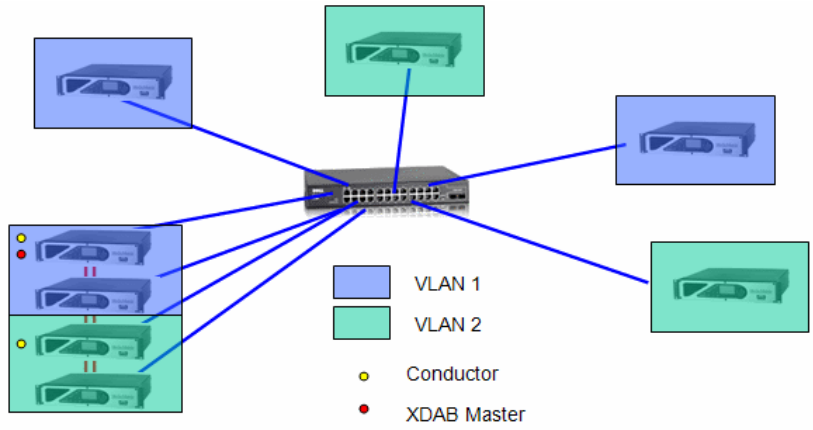
- The XDAB master can be any device within the cluster.
- The CobraNet Conductor can be any device outside the cluster.
- Remember that all XDAB slaves and their CobraNet interfaces take their clocks from XDAB.

- An XDAB master that gets its clock as a CobraNet performer that is synched to a Conductor that is in turn an XDAB slave would create an unstable clock resolution loop. XDAB would attempt to sync with CobraNet that would in turn be trying to sync with XDAB.
- The XDAB master and CobraNet Conductor will both be in the same NION automatically when default settings are used. If default settings are changed, then be sure to set the XDAB priority and CobraNet Conductor priority to insure that a single NION is both the XDAB master and CobraNet Conductor.

Notes:

- If the Conductor is placed within the cluster, then it must also be in the same NION as the XDAB master. If you increase the Conductor priority for one of the NIONs, you *must* also increase its XDAB priority to insure that the Conductor and XDAB master will stay in the same NION.
- If a Conductor for a CobraNet network is placed within an XDAB cluster, the NION containing the Conductor must also be the XDAB master.

Scenario 6 - Network with VLAN and XDAB



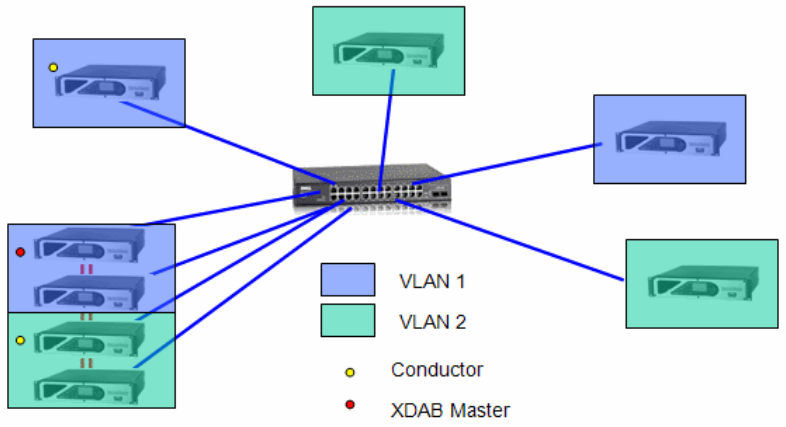
In this scenario, the network is divided into VLANs and an XDAB cluster is used. Two VLANs are shown; more are possible.

- XDAB is used to pass digital audio between NIONs within a cluster and therefore between VLANs.
- VLANs logically become one of two types in this scenario:
  - A master VLAN, i.e. the VLAN in which the XDAB master resides.
  - A slave VLAN, i.e. all other VLANs in the cluster.
- The Conductor on the one master VLAN must be either:
  - completely outside the XDAB cluster

    or
  - must also be the XDAB master.
- The same caveats regarding Conductor location as described in the *previous scenario* (on page 55) must be observed. But it is also important to properly locate the CobraNet Conductors for the slave VLAN (VLAN 2) to be sure that a clocking conflict is not created between XDAB and VLAN 2's CobraNet clock.

- Regardless of whether the VLAN 1 Conductor is inside or outside of the cluster, all NIONS in the cluster that are in VLAN 2 will be getting their clock from XDAB and cannot receive their clock from an outside Conductor. This would create a clocking conflict.
- Therefore, the Conductor for VLAN 2 must be located within the XDAB cluster, as shown.

Scenario 7 - Network with VLAN and XDAB

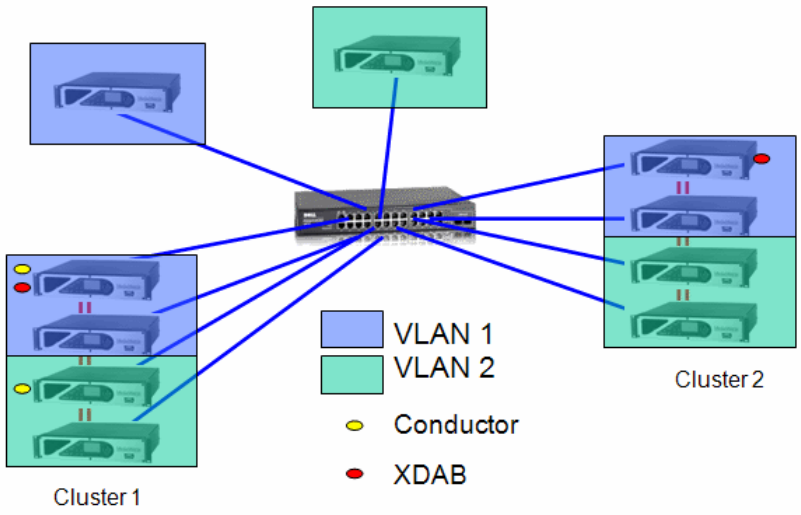


This scenario is a variant of the *previous scenario* (on page 56).

- The Conductor for VLAN1 is outside the XDAB cluster. This will still work.
- The CobraNet interface in the XDAB master will sync to the Conductor outside the cluster. That clock will become the XDAB master clock. XDAB and VLAN 1 will be in sync.

  However, the Conductor for VLAN 2 must still remain within the cluster because all XDAB slaves in a cluster will receive their clock from XDAB and not from CobraNet.
- Placement of VLAN 2's Conductor outside the cluster will cause the XDAB clock and externally sourced VLAN 2 CobraNet clock to be in conflict.

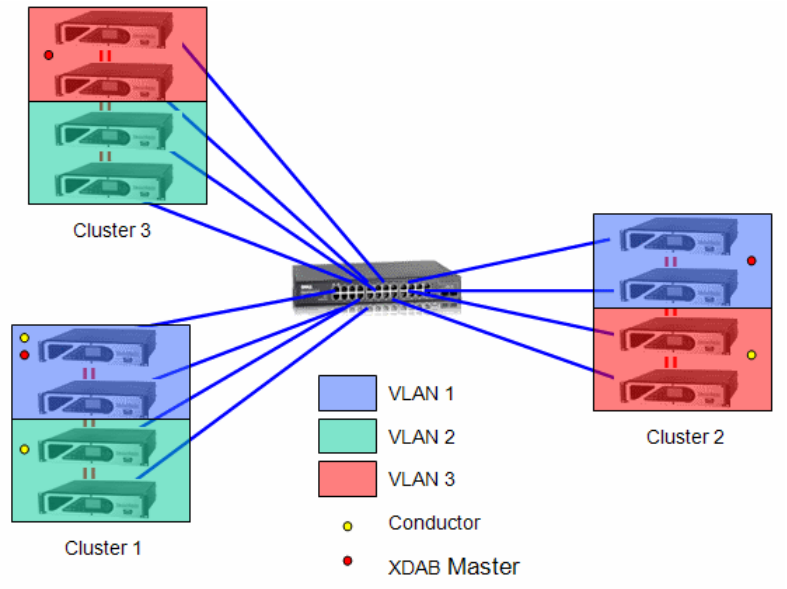
Scenario 8 - Network with VLAN and two XDAB clusters



This scenario is a variant of the *previous scenario* (on page 57), but contains more than one XDAB cluster.

- The same rules apply as in the previous scenario.
- Again, the Conductor for VLAN 2 must be within the XDAB cluster.
- It does not matter which cluster the Conductors are in. In this case, the Conductors are show in cluster 1.
- In this example, it does not matter which device in cluster 2 is the XDAB master. The XDAB master will receive its audio clock from a CobraNet Conductor in either VLAN 2 or VLAN 1, both of which are in sync with each other.
- The clock received by any device in cluster 2 via CobraNet will be the same because the Conductors for both VLANs are in cluster 1 and are synched to the same clock.

Scenario 9 - Network with VLAN and three XDAB clusters

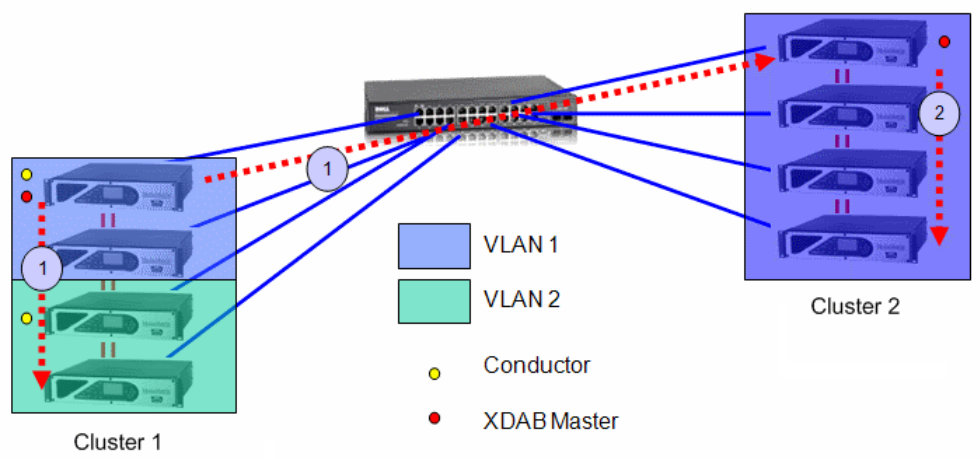


In this scenario, there are three VLANs, three XDAB clusters and no cluster contains all three VLANs.

- In cluster 1, VLAN 1 contains the XDAB master.
- In cluster 1, VLAN 2 receives its clock from XDAB and is therefore in sync with VLAN 1.
- In cluster 2, VLAN 1 is the XDAB master and receives its clock from the VLAN 1 Conductor in cluster 1.
- In cluster 2, VLAN 3 receives its clock from XDAB. This clock is derived from the Conductor of VLAN 1.
- In cluster 2, one of the devices in VLAN 3 is the Conductor for VLAN 3.
- In cluster 3, VLAN 3 is the XDAB master and receives its clock from the Conductor in VLAN 3 in cluster 2.
- In cluster 3, VLAN 2 is receiving its clock from the XDAB master in VLAN 3.
- All Conductors in this topology are ultimately deriving their clocks from the Conductor and XDAB master in VLAN 1 of cluster 1. So all clocks in this network in all three VLANs will be in sync. No clock conflicts will exist.

Further examples

Worked example 1 - follow the clock

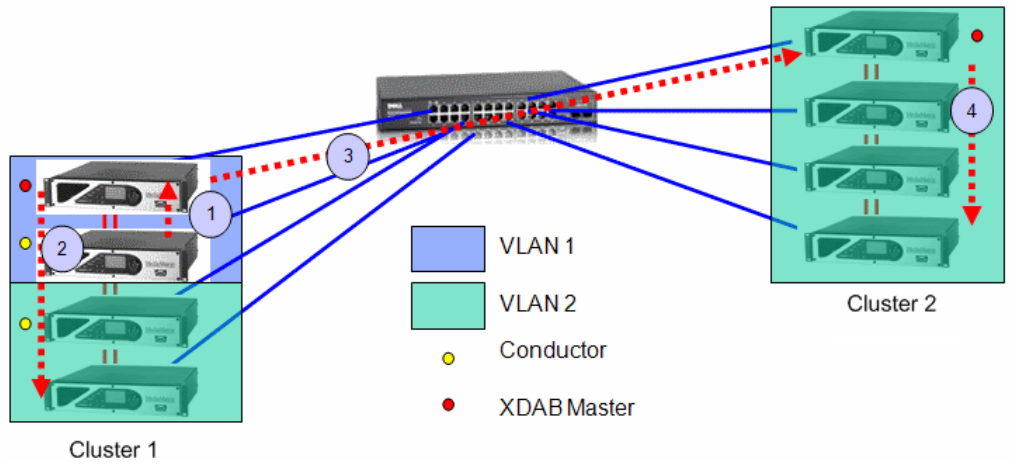


- An XDAB master NION will always receive the audio clock from its CobraNet module, regardless of whether that module is a Conductor or a performer.
- If the CobraNet clock source is external to the cluster (i.e. the XDAB master is a performer and the Conductor is external to the cluster), it will still work fine.
- If the clock source is internal to the cluster (i.e. the CobraNet Conductor is within the VLAN within the cluster), then the XDAB master and the CobraNet Conductor *must* be the same.

Notes:

- In the example above, the clock source is the CobraNet Conductor (clock path 1). This Conductor NION must also be the XDAB master. Clock 1 will be transmitted by XDAB to the other devices in the cluster and also to the other cluster on the network via CobraNet.
- In Cluster 2, the XDAB master is a performer.

Worked example 2 - a bad configuration



- The Conductor for VLAN 1 is the second device in the VLAN 1 segment within XDAB Cluster 1. It is therefore the clock source for VLAN 1 (clock path 1).
- The XDAB master in Cluster 1 is therefore a CobraNet performer in VLAN 1.
- The audio clock will originate in the Conductor from which the XDAB master (a performer) will get its clock via CobraNet.
- The performer, XDAB master, will then supply its clock to the XDAB chain (clock path 2) from which the Conductor will get its clock.
- A *clock loop* exists in this example.
- The XDAB master is relying on the CobraNet Conductor for its clock source, delivered to it via CobraNet., but the CobraNet Conductor is relying on the XDAB master for its clock source delivered to it via XDAB.
- Both devices consider the other one to be their clock source and so neither can provide a stable clock to the other.
- Clock Path 1 is a CobraNet clock distributed on the network and is an unstable clock for reasons outlined above. Therefore, the audio clock in cluster 2, which is received on clock path 1 and propagated via XDAB to the other devices in the cluster, will also be unstable. No device in Cluster 1 or Cluster 2 will have a stable audio clock.

Note: It may be possible for the two clocks (XDAB master and Conductor in cluster 1) to become stable and synchronous. But this will be a time consuming matter of chance, rather than a deterministic certainty, as the XDAB chain attempts to arbitrate a master. In the absence of any beneficial timing coincidences at the beginning of a sync attempt, the clocks would never sync up.

Appendix A
Troubleshooting

In This Appendix

Cannot access NION using IP address or IP address is unknown 62
Front panel LED indicators 63
Including debug messages in the log 66
HF2 errors 66
Low voltage warning 70
NION locking up or rebooting spuriously 71

Cannot access NION using IP address or IP address is unknown

This section explains how to connect to a NION directly via the serial port and change the IP address settings. This is only necessary under the following circumstances:

- The NION does not appear on the Remote Log tab in NWare and Pandad is functioning (i.e. other NIONs on the same network are listed). If you need to check to see if Pandad has stopped working, see *Determining if Pandad has stopped functioning* in the *Pandad Administrator Guide*.
- The NION is listed on the Remote Log tab, but when you right-click it and then click *Launch Web Interface*, the web interface is not displayed.
- You need to access a NION using its IP address, but the address is unknown and you are unable to run NWare to discover all the NIONs on the network.

Caution: It is very important that you only complete the steps in this section when under instruction from MediaMatrix Technical Support. It is possible to lose data stored on the NION or to stop it from booting if you specify settings incorrectly.

Note: The first procedure below assumes that the key used to stop the NION boot sequence is ESC, which is the default setting. This is specified by the *bootstopkey* environment variable. If you do not know the appropriate key and are unable to stop the boot sequence, contact MediaMatrix Technical Support.

Tips:

- If the NION is fitted with a front panel, you can change the IP address using the front panel interface. For more information, see *Setting the IP address* (on page 28).
- If the NION has been assigned correct IP settings, but you are still unable to start the web interface, this may be because the IP address of your PC is not compatible with the IP address of the NION. Consider changing the IP address of your PC so that it can communicate with the NION. The format of the NION IP address will be shown in the URL used when attempting to start the web interface.

⏩ *To connect to the NION via the serial port*

1. Connect a serial cable between the PC serial port and the NION RS-232 serial port.
2. Start a terminal emulator program with the following settings:
   - baud rate 57600
   - 8 bit data
   - no parity
   - 1 stop bit
   - no flow control.
3. Power cycle the NION.

4. As soon as the NION starts to boot up (and the fans can be heard), continuously press the ESC key.

   A command prompt like this => will be displayed in the console window.
5. Press Enter.

To specify a static IP address

1. Type `setenv dhcp no` and press Enter.
2. Type `setenv ipaddr <IP address>` and press Enter.
3. Type `setenv netmask <subnet mask>` and press Enter.
4. If you want the settings to be saved and used each time the NION boots, type `saveenv` and press Enter.

   If you omit this step, the settings will only be used for the current session.
5. Type `boot` and press Enter.

To specify an IP address automatically using DHCP

1. Type `setenv dhcp yes` and press Enter.
2. If you want the settings to be saved and used each time the NION boots, type `saveenv` and press Enter.

   If you omit this step, the settings will only be used for the current session.
3. Type `boot` and press Enter.

Some examples

Scenario	Command to use

The NION is configured with a static IP address, but you want to assign a new address that is temporary.	`setenv ipaddr 10.1.10.100`
	`setenv netmask 255.255.0.0`
	`boot`

You want to use DHCP for this session and each time the NION boots.	`setenv dhcp yes`
	`saveenv`
	`boot`

You want to use a static IP address for this session and each time the NION boots.	`setenv dhcp no`
	`setenv ipaddr 10.1.10.100`
	`setenv netmask 255.255.0.0`
	`saveenv`
	`boot`

Front panel LED indicators

There are several LEDs on the NION front panel that help indicate unit status.

Fault	
RED	Audio not working.
OFF	Audio working.

The Fault LED tracks the state of the fault relay. (The fault relay signals appear on pins of the GPIO connector.)

Note: The RED state does not necessarily indicate a problem, but that audio is not actively being processed and passed. This state occurs normally when the unit is rebooting or has not yet been configured to run a Project. It also occurs when the unit has encountered a problem and can no longer process and pass audio.

X-DAB	
GREEN	Primary and backup rings are operational.
YELLOW OR GREEN BLINKING	Running in backup with single cable missing - all audio present.
YELLOW/RED OR RED BLINKING	Running in backup mode with multiple cables/nodes missing - some audio gone.
RED	Failure - some or all audio gone. Not running in backup mode.
OFF	XDAB is not in use (in the current Project/Role for this NioNode).

Note: The XDAB LED is updated only when XDAB is used by the NioNode in the current Project and the NioNode is up and passing audio.

LAN	
GREEN	Ethernet link.
OFF	No Ethernet Link.

CobraNET	
GREEN	Ethernet link.
GREEN	Ethernet link and NioNode is CobraNet Conductor.

BLINKING	
RED	No link or CM-1 missing or malfunctioning, and NioNode is configured to use CM-1.
OFF	No link or CM-1 missing or malfunctioning, and NioNode is not configured to use CM-1.

Note: Even if the NioNode has not been configured to use its CM-1 (in the project design), link and Conductor status are still reported and the unit will be visible as a CobraNet node on the network it is attached to. You will only see RED, however, if the NioNode has been configured to use its CM-1 and there is a problem with link or with the CM-1 module.

IDE	
GREEN	Mass storage (CompactFlash) read or write activity.
OFF	No activity.

Tip: The IDE LED indicator is remarkably similar to the disk status LED you may have on the front of your PC or on the bezel of your laptop.

Attn	
RED BLINKING	Indicates there is an error or warning condition of interest.
OFF	No status change of interest.

Tip: This indicator is paired with a button. When the LED blinks, the button can be pressed to cause the LCD to navigate to a page displaying the source of the condition.

Attn	
OFF	Unit is off.
ORANGE	Unit is booting up or down.
GREEN	Unit has booted up.

Including debug messages in the log

By default, the NION log contains messages generated for a number of different events, including:

- users logging on and off
- roles starting and restarting
- muting and unmuting
- time synchronization.

If you are troubleshooting a problem on a NioNode and you want to view debug messages in the log (and not just the default messages), you must enable the logging of each type of message using the web interface.

Tip: Entries are added to the log until 2MB of storage has been used (and approximately 22,000 lines have been stored). 1MB of the oldest log data is then deleted automatically, making room available for new entries. The available space is the same, regardless of the amount of compact flash memory fitted to the NION.

To include debug messages in the log

1. In NWare, click the **Remote Log** tab at the bottom window.
2. In the **Targets Found** pane, right-click on the NioNode and then click **Launch Web Interface**.

   A browser will be opened displaying the home page of the selected NioNode.
3. In the browser, click **Special** at the top of the page.
4. At the bottom of page, Click **advanced**.
5. Under **Debug Logging**, select check boxes next to the types of debug messages you want to include in the NION log.

   If you want to include all types of debug messages, scroll to the bottom of the window, and then click **set all**.
6. Click **apply**.
7. Specify your username and password. The default username is *superuser*; it has no password.

HF2 errors

HF2 is the generic term for a class of errors that are caused by a communication failure between the NION processor and CobraNet CM-1 module. This type of error may appear as one of the following in a NION error log:

```
cm1 not detected : /dev/pion/cm10: timeout waiting for HF2 to go high

peek aborted after 5 tries: /dev/pion/cm10: timeout waiting for HF2 to
go high

poke/peek driver exception : /dev/pion/cm10: timeout waiting for HF2 to
go high
```

A hardware handshake line between the NION and CM-1 has failed to operate correctly, i.e. the CM-1 has become unresponsive.

The causes of HF2 errors

HF2 related errors could have two basic causes:

- A hardware error. The physical hardware is at fault.
- The firmware running on the CM-1 has malfunctioned and cannot respond to the NION.

Case 1 - Hardware error

In this case the interface between the CM-1 and NION has failed due to a chronic hardware problem. This condition can be identified by persistence of the error through multiple power cycles of the NION. A hardware fault can only be remedied by repair or replacement of the failed component. Please consult your dealer for further information regarding repair or replacement of hardware.

A hardware error can also be caused by a NION operating at elevated temperature. Address cooling and ventilation issues when this cause is suspected.

Case 2 - Firmware malfunction

Firmware malfunction is the primary focus of this troubleshooting section. This cause of failure is characterized by proper operation of the NION followed by occurrence of an HF2 error. Subsequent power cycling of the NION can return the device to proper operation. Although the root cause is a firmware problem, there are network related issues that can stimulate the problem and steps that can be taken to mitigate it.

The CM-1 firmware, up to and including version 2.9.16, contains a bug. This bug will allow a stack overflow to occur during times of excessive network traffic that will render the CM-1 inoperative. A fix is not currently available, but is being worked on. This problem can occur in any CM-1 module installed in a NION, CAB or Mainframe.

Note: The CAB 4n is available with both CM-1 and CM-2 modules. Only CM-1 modules are affected.

Verification of the problem - all conditions will be present

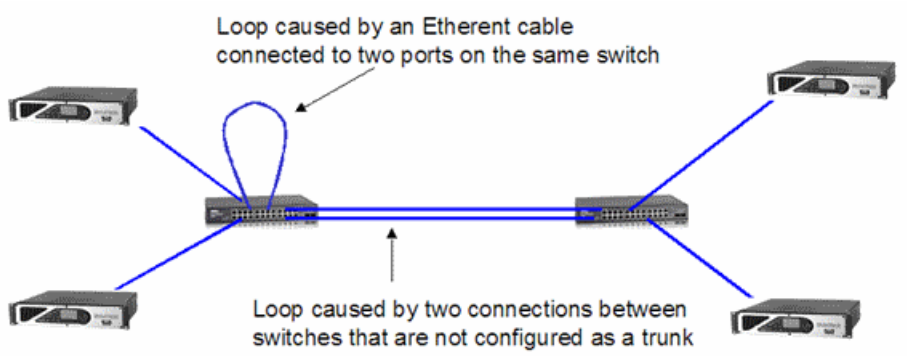
- The CM-1 will initially work properly.
- The CM-1 will become unresponsive. This can be indicated by an inability to change bundles.
- An HF2 related error will be logged.
- All audio bundles in and out of the CM-1 will stop.
- The CobraNet interface will not show active in CobraNet Discovery.
- The LED indicators on the CobraNet RJ-45 Ethernet connectors will most likely be static and in a random state. They will not be blinking in the normal pattern that indicates CobraNet activity. In some cases, the lights will blink in a repeatable pattern of 7,6,2.
- A hardware reset will correct the problem.

The causes of firmware malfunction

Presence of excessive network traffic, also known as a *data storm*, can cause a stack overflow to occur. A data storm can be caused by the presence of a loop in the network. Loop problems can be more acute in larger networks and in networks that contain gigabit Ethernet links. A data storm can also be caused by malfunctioning equipment in rare cases.

Some devices will transmit multicast data in normal operation. In a large network, if many or all devices on the net do so by coincidence at the same time, a condition similar to a data storm can occur and have similar consequences for a brief instant.

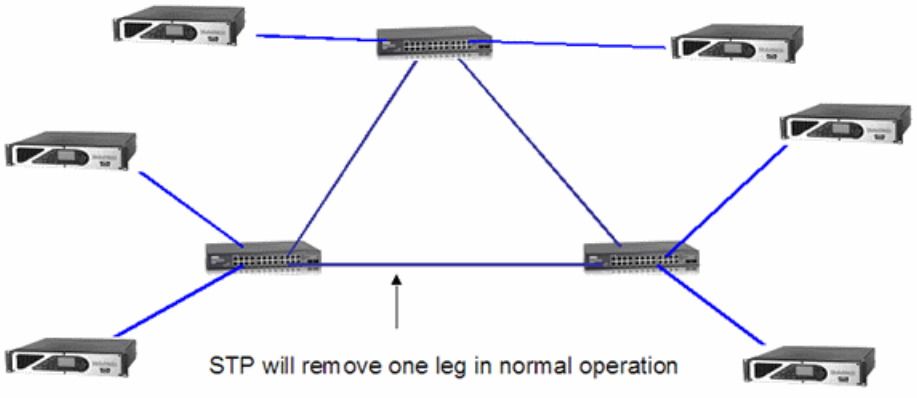
To put it in audio terms, a network loop is analogous to an audio feedback loop. The screech one hears in audio feedback is due to continuous positive reinforcement of the signal. A network loop causes a similar positive reinforcement of the data. Data packets are replicated and increase in quantity with each hop through a switch until all available network bandwidth is consumed.


Loop caused by an Etherent cable
connected to two ports on the same switch
Loop caused by two connections between
switches that are not configured as a trunk

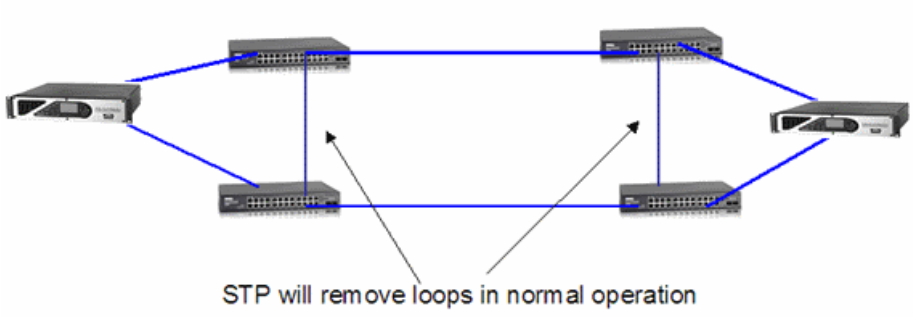
Many Ethernet switches contain some variant of the Spanning Tree Protocol (STP, RSTP or MSTP) that detects and logically removes loops. Standard STP should not allow a connection to be made until it is sure that the connection will not cause a loop. MSTP and RSTP can behave a little differently. If a new connection is made through a port that the protocol previously considered to be an *edge* port. (i.e. it cannot be connected to another switch), then the port will be immediately enabled. If this connection is such that it can create a loop, then a data storm can occur. Explicitly setting ports within an RSTP/MSTP managed switch to be *edge* or *bridge* ports, per their usage, may alleviate this problem.

Commonly used fault tolerant techniques for CobraNet networks

- Intentional creation of a loop, with reliance on STP to remove it, in order to create a spare connection that will be automatically activated when a link in the network goes down.



- Use of the primary and secondary Ethernet connections on a CobraNet interface along with redundant and interconnected switches. Proper use of CobraNet DualLink with redundant networks will intentionally create a loop that is automatically removed or restored by STP.



Loop scenarios

A loop is present on the network. A number of scenarios can be seen:

- The switches are powered up and stable. STP has logically removed all loops. CobraNet devices are then powered up. No loop effects will be seen.
- CobraNet devices are powered up and stable. One or more switches are powered up (or powered down then up). A momentary data storm may occur long enough to cause CM-1 failures.
- A network topology, such as either of the examples in the *Commonly used fault tolerant techniques for CobraNet networks* (on page 68) section, is in use and functioning properly with redundant links having been removed by STP. A link between switches is then broken. STP creates a new path and the network continues to work properly. Later, the bad link is repaired. When the link is reestablished, a loop is momentarily created until STP removes it.
- Rapid Spanning Tree (RSTP) is a newer variant of Spanning Tree (STP) in which management of the links is accomplished an order of magnitude faster than standard Spanning Tree. The net effect of this operating characteristic is that a network using RSTP can experience data storm like events in the course of its normal operation while resolving loops.

What we know

- CobraNet modules can crash in the presence of excessive network traffic (data storms).
- Excessive traffic is almost always caused by the presence of a loop but can, in some cases, be a consequence of normal operation.
- Loops, in conjunction with the use of Spanning Tree or an analogous feature such as RSTP, MSTP or Meshing (a proprietary HP protocol), can be intentionally used to create fault tolerant network topologies.
- Different topologies can cause loop effects.
- Loops and use of Spanning Tree will typically only apply to networks that use more than one switch. Use of more than one switch is common.

Mitigation

- Do not use topologies that intentionally employ loops when their use can be avoided.
- Check for the presence of, and remove any, unintended loops.
- Do not use Rapid Spanning Tree (RSTP or MSTP). Use STP.

- Use switches that allow port based bandwidth throttling or data storm control. The configuration of a throttling feature will be switch vendor specific. Configure each port directly connected to a CobraNet device to limit the amount of traffic allowed to go from the port to the CobraNet device.
  - Data storm control often consists of severely limiting or stopping multicast data. Be sure that this feature is not configured to prevent the passage of normally occurring multicast CobraNet data which includes beat packets, reservation packets and multicast bundles.
  - A good rule is to limit traffic going to a CobraNet device to 50 megabits. Less traffic may be acceptable and safe depending on the number of bundles and channels received by a device. More than 50 Mbit of bandwidth will seldom be required when using CM-1 modules.
  - The specific bandwidth to allow should be the amount of received data plus approximately 10 to 15 megabits
  - A CM-1, when fully configured to receive 32 channels of 48 kHz sample rate audio data at standard latency, will receive approximately 32 Mbit of audio data + beat packets + SNMP + serial or packet bridge. The additional 10~15 Mbit is intended to accommodate data other than audio bundles.
  - Additional requirements for bandwidth will be created by the use of:

    Lower latencies – approx +10% per decrease in latency

    96 kHz sample rate - doubles the required bandwidth per channel

    Packet bridge – use dependant

    Serial bridge – use dependant

    SNMP – use dependant.

Best practices

- Explicitly set the CobraNet Conductor priority and XDAB master priority in all devices to insure they are set correctly.
- Locate the CobraNet Conductor outside an XDAB cluster when possible.
- Set all Conductor priorities to 0 in all devices except those that should be allowed to be Conductors. For those devices that should be Conductors, make their priorities the same.
- Devices with CM-1 modules are preferred as Conductors over devices that have CM-2 modules.

Low voltage warning

When using phantom power for high current draw condenser mics on NIONs, and when all four I/O slots are populated with ML II cards, the +/-24V power voltage may drop a little. This is because on some NIONs, the 24V power supply current limit is slightly low. This voltage drop is sometimes sufficient to trigger the voltage warning: the **Attn** button on the front of the NION will flash red, and pressing it will bring up the voltage monitoring screen, with the +/-24V measurements highlighted.

Under most conditions, the voltage drop will not have any effect on the functioning of the NION, because the full 24V is actually substantially more than the cards require. The 24V supplies feed local regulators on the cards which generate a substantially lower voltage for the analogue i/o circuits - this decouples the analogue circuitry from variations in the 24V supply.

The problem can be worked around by using less power hungry microphones or by removing one of the ML II cards from the unit. If you cannot do this, contact your local NION service agent.

NION locking up or rebooting spuriously

If you load a role onto a NION and find that the unit has locked up, or keeps rebooting spuriously, it may not be possible to erase the role via the front panel or the web interface using the normal methods.

The NION includes a service menu, accessible at boot time, which will allow you to boot the unit, but not load the role. It can then be erased.

Caution: It is very important that you follow the instructions in this section carefully. Do not experiment with other options in the service menu. You could make the NION inoperable.

To stop the role from loading automatically at boot time

1. Switch off the NION by pressing the **Power** button, and then selecting **OK**.
2. Hold down the two buttons indicated below.

3. While holding down the buttons, press the **Power** button to switch the NION back on.
   This menu will be displayed.

```
OPTIONS:
> WHEEL TO EDIT
> ATTN TO BOOT

UPDATE MEDIA
```

4. Turn the wheel clockwise until **BOOT MODE** is displayed.
5. Push the wheel button.
6. Turn the wheel to select **QUIET**, then push the wheel button to select the option.
7. Press **Attn**.
   The NION will boot. You will then be able to erase the role without running it.
8. Reboot the NION.
   The NION will start in NORMAL boot mode.

Appendix B
Connector ports

In This Appendix

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Audio connections

Each audio connection on the CAB and NION products is a single, three-wire, balanced analog circuit. The connections are identical for both microphone, line input and line output connections. We recommend that audio connections are made with high quality shielded wire.

Notes:

- As with any electronic connection, care should be taken to ensure that the termination is solid. There should be no stray wire strands, kinks or nicks in the wire jacket for a proper termination.
- Stranded wires should not be soldered. Solder will cold flow under the pressure of the screw terminal, causing a loose connection to develop over time.

Analog balanced audio connection using standard cable

Positive (+)
Negative (-)
Shield (SH)/Ground (G)

If you want to connect an unbalanced audio source to the CAB or NION, make the connections as shown in the table below.

Unbalanced input cable	CAB or NION input connector
Positive (+)	Positive (+)
GND	GND and negative (-)

CAT 5 connections

Category 5 cable, or *CAT 5* as it is commonly known, is a wiring standard that consists of 8 conductors, identified into 4 pairs, and although only two of these pairs are used, all four are terminated.

It is a UTP (Unshielded Twisted Pair) configuration. The cable is coupled to in-line RJ-45 connectors, also a Bell/AT&T standard. Special crimping tools are required to make the termination; these are widely available, as are the connectors.

Note: A ratcheting type crimping tool is *highly* recommended. The use of non-ratcheting crimping tools, while occasionally adequate, typically results in considerably higher failure rates for field terminated connections.

Just like telco wire, there are stranded and solid varieties of CAT 5 cable. This is important to know, because the RJ-45 connector is different for each type of wire. The standard *bent tine* connector is intended for use with solid core wire, and the *aligned tine* connector is for use with standard wire. The *bent tine* connector will generally work on stranded wire, but not the other way around.

The EIA standard requires no more than 1/2 inch be left untwisted. More than 1/2 inch of untwisted cable will affect performance at high bit rates. Although only 2 of the 4 twisted pairs are used for Ethernet, it is important that all pairs be terminated, and that the conductors be twisted together in pairs. The illustrations should give you the basics for getting your cables, and your audio system up and running. Although pre-made, molded style cables are preferred, they can be impractical, since your cabling route, distance and locations are based on the jobsite conditions and not your test bench.

Although the 8P8C modular connector (RJ-45) used in CAT 5 cabling originates with AT&T, it is functionally different for configuring Ethernet cabling. The Bell System uses a series of colors to identify wire pairs. This color scheme identifies the pair numbers, and conductor polarity, and applies to the *wire*, not the connector. It is important to know what pairs are which, and the function of the pins on the RJ-45 connector. The colors are BLUE, ORANGE, GREEN and BROWN for the first four pairs.

What is often confusing is that the pair numbers do not line up with the pin numbers on the 8P8C modular connector (RJ-45) connector. In other words, conductor one of the cable (White w/Blue Strip) is not terminated to pin one of the connector. The AT&T connecting standard always uses the middle pins for the first pair. After that, they are staggered around, primarily to prevent crosstalk between adjacent pairs. For Ethernet, only the ORANGE and GREEN pairs are actually used.

For Ethernet, the BLUE and BROWN pairs are not used (except in some implementations of Power over Ethernet (PoE)).

Notes:

- A single CAT 5 cable run must not exceed 100 meters.
- Make sure your connector matches your cable type. If you are not sure, use the *bent tine* variety.
- When terminating CAT 5 cable, it is important that the natural twist of each pair is carried through as close as possible to the point of termination at the connector.
- We recommend that you familiarize yourself with the wiring color schemes so they are second nature to you. An error in the cabling of an Ethernet network is often the primary cause of system errors.

- It is very important that you build the cable with all pairs properly terminated. This will prevent any confusion later, and give your cable a solid mechanical connection.
- The use of pre-made and pre-tested cabling can greatly simplify and expedite installation for wiring within a rack.
- Be sure to follow all applicable cable installation specifications for Ethernet networks. This information is specified by the TIA/EIA-568 standards that are available from ANSI, TIA, and EIA.

GPIO overview

NION and CAB products include a versatile GPIO (General Purpose Input Output) system at the rear for terminating external logic, controls, relays and other external systems. Each control pin is supported by NWare for configuration, control and monitoring. Any combination of control pins may be used simultaneously, regardless of the configuration.

Caution: The pin assignments for the GPIO ports on the NION and CAB devices are not the same. Please be sure to check the documentation carefully when connecting devices to the ports.

Configurable general purpose ports (16 control pins)

These ports represent the bulk of the GPIO functionality. Each of these ports can be configured as follows:

- Digital In (3.0V TTL logic - Low: 0 VDC - 0.8 VDC; High: 2.0 VDC - 24 VDC)
- Digital Out (3.0V TTL logic - Low: 0V DC - 0.4 VDC; High: 2.4 VDC - 3.3 VDC)
- Analog In 1K, 12V (using external 12 VDC power source)
- Analog In 10K, 12V (using external 12 VDC power source)
- Analog In 10K, 24V (using external 24 VDC power source)
- Analog In 1K, self powered (pin feeds required voltage through pot or switch to common)
- Analog In 10K, self powered (pin feeds required voltage through pot or switch to common)
- Rotary Encoder (requires 2 pins and a common)
- Raw (all modes available, software configurable)
- Clock signals on pins 6-8.

High current output ports (4 ports)

Each high current port provides 11.5VDC at 0.5A. High current outputs can be configured for straight logic (on/off) or PWM (Pulse Width Modulation) operation.

Fault relay

A single system relay is configured for supervising project faults. This Form C relay provides 1A contacts and is activated when the front panel fault LED is illuminated, which indicates a muted condition. Muted conditions could indicate many things, including the following:

- A firmware/Role mismatch
- A voltage rail malfunction
- XDAB Fault Policy exceeded
- Network or Network Synchronization lost.

The behavior of the fault relay is summarized below.

Event	Fault relay action taken
Role running	Pin 25 is connected to pin 12
Role stopped	Pin 25 is connected to pin 13
Unit or system muted	Pin 25 is connected to pin 13
Project halted	Pin 25 is connected to pin 13
Project erased / no project loaded	Pin 25 is connected to pin 13
Power off	Pin 25 is connected to pin 13

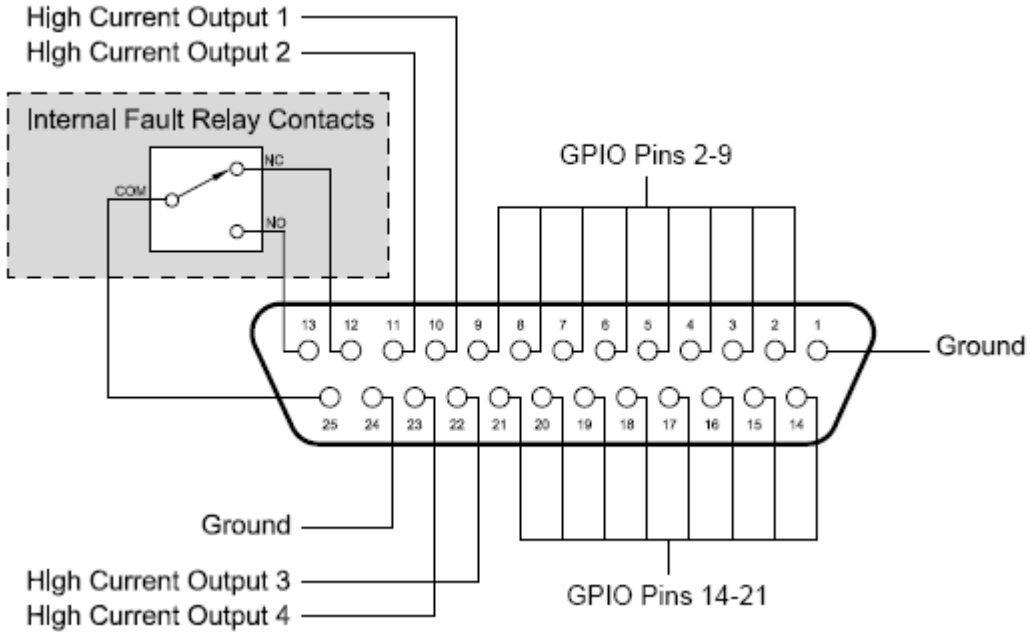
Connection

A 25-pin DSub connector (DB-25) is used for accessing the GPIO functions. Although you can terminate GPIO functions directly to the DB-25 connector, we recommend that you use the optional breakout accessory (*GPIO-25: Peavey Part# 00510490*).

The GPIO-25 is a convenient way to access each pin and facilitates easy rack wiring and troubleshooting. The GPIO-25 is a DIN rail package and includes removable Euro connectors for terminating the pins. A single DB-25 male/female cable connects the GPIO-25 to the NION or CAB 4n.

GPIO pin assignment

The illustration below shows the pin assignments for the GPIO system. If you are using the GPIO-25, use the screened pin numbers to identify the functions available for the associated captive wire terminal.


High Current Output 1
High Current Output 2
Internal Fault Relay Contacts
COM
NC
NO
GPIO Pins 2-9
13 12 11 10 9 8 7 6 5 4 3 2 1
Ground
25 24 23 22 21 20 19 18 17 16 15 14
Ground
High Current Output 3
High Current Output 4
GPIO Pins 14-21

Pin	Function	Pin	Function
1	Ground	14	Configurable GPIO
2	Configurable GPIO	15	Configurable GPIO
3	Configurable GPIO	16	Configurable GPIO
4	Configurable GPIO	17	Configurable GPIO
5	Configurable GPIO	18	Configurable GPIO
6	Configurable GPIO	19	Configurable GPIO
7	Configurable GPIO	20	Configurable GPIO
8	Configurable GPIO	21	Configurable GPIO
9	Configurable GPIO	22	High current output 3
10	High current output 1	23	High current output 4
11	High current output 2	24	Ground
12	Fault Relay (1=Running)	25	Fault Relay Common
13	Fault Relay (1=Stopped/Muted)		

State 1 indicates continuity with pin 25.

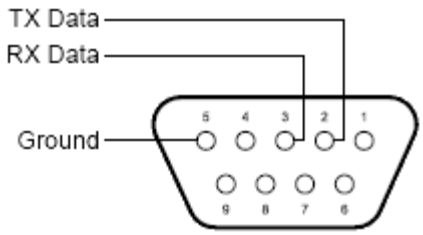
Serial communications

NION supports serial communications via two female DB-9 connectors on the rear of the unit. The first connector supports RS-232 and the second supports both RS-422 full duplex and RS-485 half-duplex.

Follow the pinout drawings and charts below for terminating the different protocols.

Note: Only one protocol can be used on a particular port at any one time.

RS-232 serial port



Pin	Function
1	Not used
2	TX data
3	RX data
4	Not used
5	Ground
6	Not used
7	CTS
8	RTS
9	Not used

Notes:

- Transmit (TX) and Receive (RX) are from the point of view of the MediaMatrix device. Connect them to the opposite port of the remote unit.
- Pins 7 and 8 are not required for normal operation.

RS-422/485 serial port in RS-422 mode

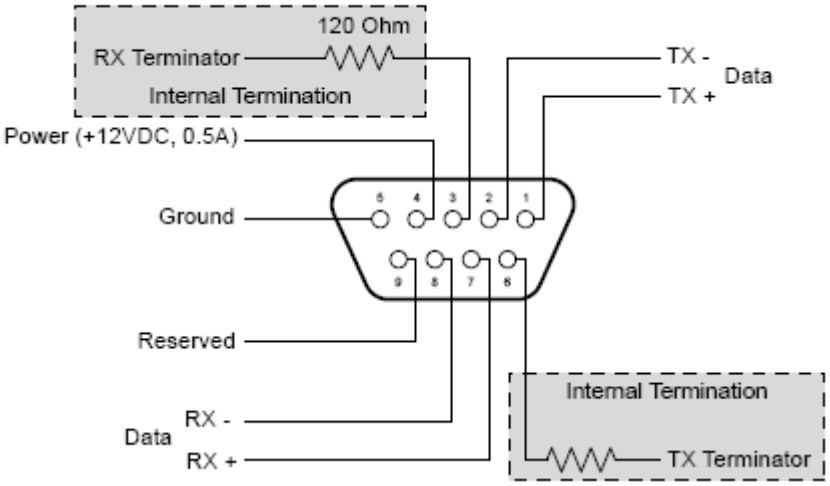
Four RS-422 separate data pairs are provided for transmit (TX) and receive (RX). Additionally, there is a 120 Ohm terminating resistor provided for each data pair for applications that require an EOL termination. The termination is optional and is accessible by connecting the terminating pin for each data transport pair.

To enable termination for the transmit pair, connect the terminating resistor pin (TX Terminator) to the positive data transmit (TX+) pin.

To enable termination for the receive pair, connect the terminating resistor pin (RX Terminator) to the positive data receive (RX+) pin.

Power (+12VDC) is provided on pin 4 and is referenced to ground, pin 5. The power pin is protected by a self-resetting fuse and is limited to 0.5A, max.

Note: Transmit (TX) and Receive (RX) are from the point of view of the NioNode. Connect them to the opposite port of the remote unit.



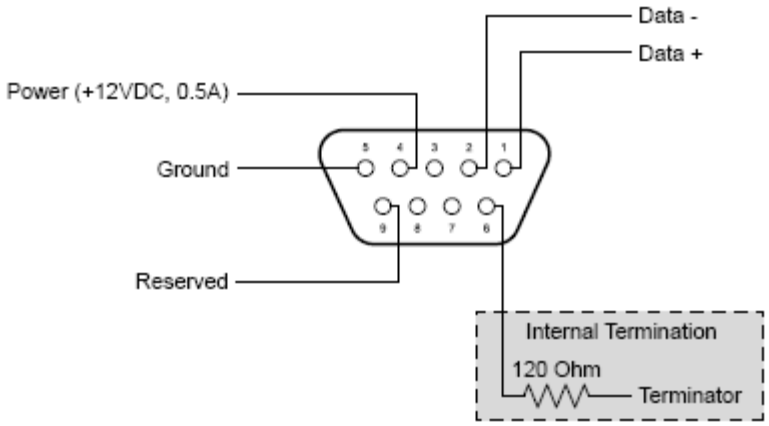
Pin	Function	Pin	Function
1	TX Data +	6	TX 120 ohm terminating resistor
2	TX Data -	7	RX Data +
3	RX 120 ohm terminating resistor	8	RX Data -
4	+12 VDC (0.5A)	9	Reserved (no connection)
5	Ground		

RS-422/485 serial port in RS-485 mode

For RS-485 applications the serial port is configured for half-duplex operation. A single data pair is provided for transmit (Data+) and receive (Data-).

Additionally, there is a 120 Ohm terminating resistor provided for applications that require an EOL termination. The termination is optional and is accessible by connecting the terminating pin (TX Terminator) to the positive data (Data+) pin.

Power (+12VDC) is provided on pin 4 and is referenced to ground, pin 5. The power pin is protected by a self-resetting fuse and is limited to 0.5A, max.



Pin	Function	Pin	Function
1	Data +	6	TX 120 ohm terminating resistor
2	Data -	7	Not used
3	Not used	8	Not used
4	+12 VDC (0.5A)	9	Reserved (no connection)
5	Ground		

Serial control protocols

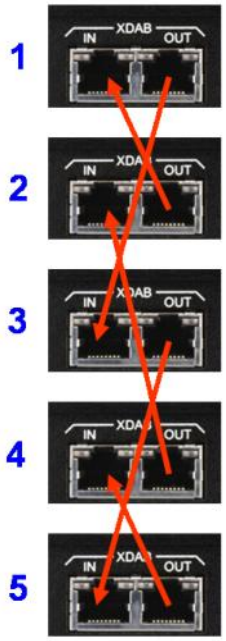
You may use any of the following protocols with these ports:

RATC2	RATC2 is the improved version of RATC that was introduced with the NION platform, but is also supported by nControl. Very similar to RATC1, RATC2 introduces shortened commands, and several extra functions.
RATC1	RATC1 is the first generation protocol that was used in Classic frame-based MediaMatrix systems. RATC1 for NioNodes and nControl nodes is equivalent to what was called RATC in Classic MediaMatrix.
PASHA/PageMatrix	The classic PASHA protocol used on miniframes and mainframes.
PASHA/XControl	Provides basic S (Set) PASHA functionality with X-Net2-style trigger commands.
PASHA/Legacy	Designed for projects that contain legacy MediaMatrix nodes that are controlled by external programs using the PASHA protocol. When you want to replace the legacy nodes with NioNodes, select the *PASHA/Legacy* option and you will not need to update your external program code. The option ensures all hex values are returned from nodes in lower case instead of upper case to match the original MediaMatrix PASHA protocol.

XDAB communications

Connecting multiple NIONs

When you are connecting multiple NIONs together using the XDAB ports, as described in the section *Using XDAB clusters with VLANs and CobraNet* (on page 51), we recommend that you connect them in the configuration shown below.



For information on the technical specification of XDAB, see *XDAB performance (NION n3, NION n6)* (on page 90).

Appendix C
Technical specifications

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AES card DIP switches 90
XDAB performance (NION n3, NION n6) 90
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Mechanical specifications 92

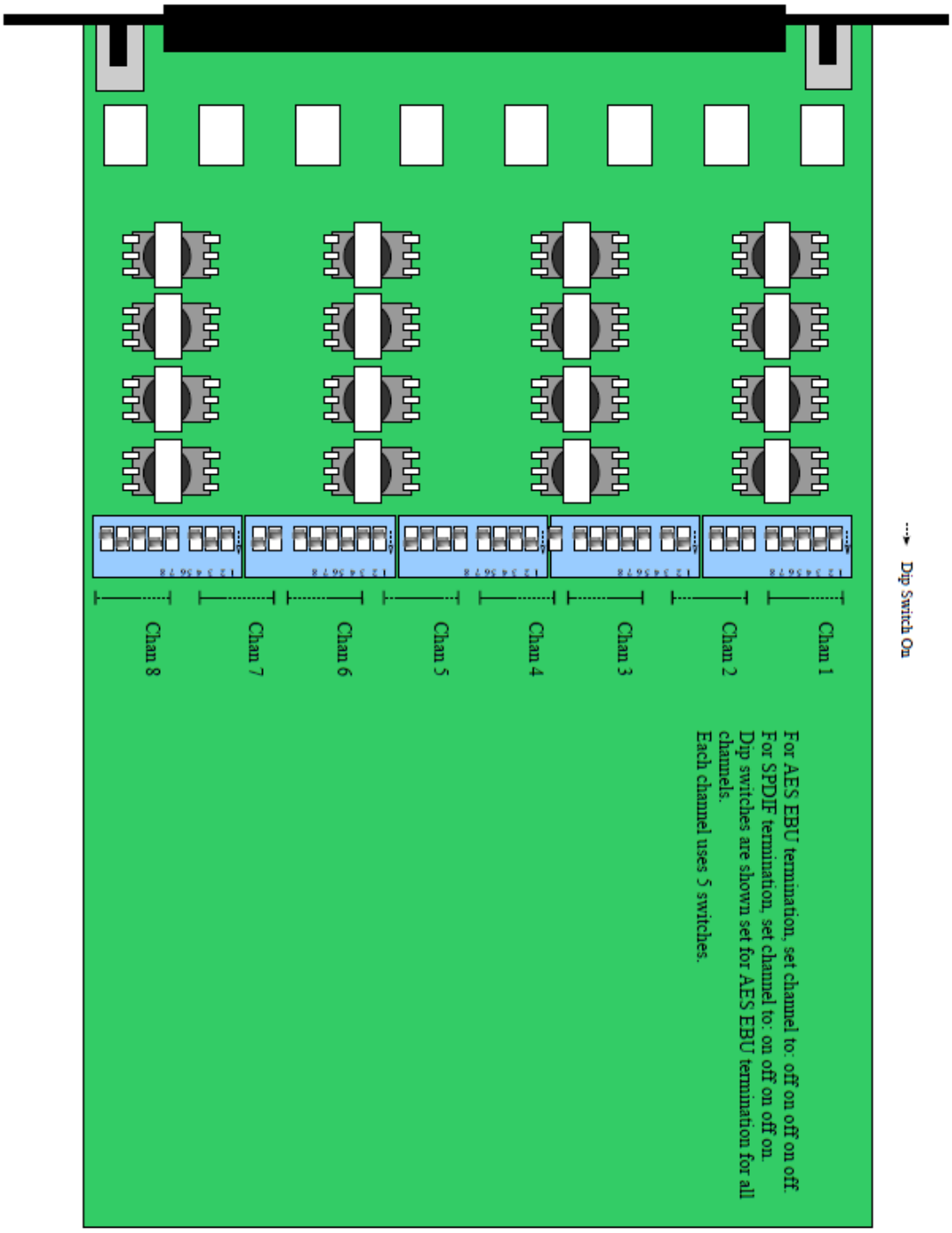
Rear panel connections

Mains Power	100v > 240v 50/60 Hz 300W A/C. Terminated to rear panel IEC connector.	
LAN	Female RJ-45 - transports control and communications via Ethernet on Category 5e (CAT5e) cabling.	
XDAB	Dual Female RJ-45 Connector - proprietary LVDS signaling via shielded Category 6 (CAT6) cable terminated with shielded male RJ- 45 jacks, max. length 10 feet (3m). NION n3, n6 only.	
RS-232 Serial	Female DB-9 - supports general purpose RS-232 communications.	
RS-485/422 Serial	Female DB-9 - supports bi-directional RS-485 half-duplex and RS-422 full duplex multidrop serial communications.	
Audio Network Module	CobraNet	CM-1 Module with 2 Female RJ-45 connectors - transports digital audio via CobraNet audio network on Category 5e (CAT5e) cabling terminated with male RJ-45 jacks.
	Dante	DLM Module with 2 Female RJ-45 connectors - transports digital audio via Dante audio network on CAT-5 or better cabling terminated with male RJ-45 plugs.
GPIO	Female DB-25 - breaks out configurable general purpose logic and status connections to external DIN terminating block (optional).	
I/O Bays	Proprietary I/O card slots. Support for proprietary audio and interface cards, available separately.	

Digital audio performance

Audio Processing	32-bit floating point audio.
Processing	PowerPC Host (Linux OS) with 6 (NION n6) or 3 (NION n3, NION nX, NION nE) ADI Sharc Hammerhead digital signal processors.
DSP MFLOPS	2400 sustained, 3600 peak (NION n6); 1200 sustained, 1800 peak (NION n3, NION nX, NION nE).
Sample Rate	Configurable, 22.05KHz, 24KHz, 32KHz, 44.1KHz, 48KHz, 64KHz, 88.2KHz, 96KHz.
Latency	Configurable, minimum latency (analog in to analog out @ 48kHz sample rate, 8 sample vector) 1.8 msec. Total latency varies with audio configuration.
Storage	2GB compact flash. Supports OS, configuration, control and .wav audio.

AES card DIP switches


Dip Switch On
Chan 1
Chan 2
Chan 3
Chan 4
Chan 5
Chan 6
Chan 7
Chan 8
For AES EBU termination, set channel to: off on off on off.
For SPDIF termination, set channel to: on off on off on.
Dip switches are shown set for AES EBU termination for all channels.
Each channel uses 5 switches.

XDAB performance (NION n3, NION n6)

Data Format	32-bit floating point audio.

Protocol	Proprietary.
Channels	448 channels at 48kHz, 256 channels at 96kHz. **Note:** It is possible to exceed the 448 channel limit, but it is not recommended. Testing has shown that using a greater number of channels can produce unexpected results.
Maximum XDAB latency	3 sample vectors.
Synchronization	+/-20ns box-to-box word clock sync (via Ethernet).
Redundancy	Dual counter-rotating rings.
Cable length	10 foot (3m) maximum cable length.

CobraNet performance

Data Format	16/20/24-bit audio (default = 20)
Protocol	Ethernet with Proprietary CobraNet protocol.
Channels	64 channels at 48kHz

GPIO

Connections	20 ports configurable pins and a fault output via internal Form-C relay
Digital input	Vin < 0.8VDC = logic 0; Vin > 2.0VDC = logic 1 (1.2V hysteresis).
Analog input	0.0VDC < Vin < 24.0VDC; 12-bit analog converter precision.
Digital output	logic 0 Vout = 0.0VDC, Isink <= 2mA; logic 1 Vout = 3.3DC, Isource <= 2mA.
High current outputs	4 ports, each with a 0.5A self-resetting fuse and protection diodes for driving inductive loads. Vout = 11.5V nominal @ Isource = 0.5A. Direct short protection from ground to +36V.
Relay contacts	Form C contacts rated at 0.3A @ 125VAC or 110VDC, or 1A @ 30VDC.

Mechanical specifications

Chassis Style	2RU EIA rack package
Installation	EIA rack mount only
Dimensions	19 in. W x 16.8 in. D x 3.5 in. H
Cooling	Forced air, front and side panel intake, rear exhaust.

Appendix D
Reference Information

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Architect's and engineer's specifications

The audio processing node shall be a 2RU industrial package designed for fixed installation in engineered audio and communications systems.

The unit shall include an architecture based on an integrated floating-point Digital Signal Processor (DSP) engine with at least 3 DSP chips. The DSP shall operate with a common internal digital audio bus and support at least 448 simultaneous high-speed digital audio channels. The digital audio bus shall include an external expansion port that supports an additional 448 audio channels of bus-level connectivity for connecting additional units.

Note: It is possible to exceed the 448 channel limit, but it is not recommended. Testing has shown that using a greater number of channels can produce unexpected results.

Separate transmit and receive ports shall be provided for the external digital audio bus. Software devices shall be included to allow the digital audio expansion ports to be easily integrated into the configuration file. The DSP shall be completely configurable via a Windows-based software utility, with additional tools for creating user interface clients and integration with third-party control systems. Customizable I/O, control and signal flow design algorithms shall be integrated within the design environment for intuitive system configuration. This software shall include an XML architecture. Support for standard Ethernet management, including, but not limited to SNMP shall be standard from an integrated, rear-panel LAN port. The audio processing node shall include an embedded Linux operating system. The operating system shall reside on non-mechanical IDE storage media. The storage system shall include support for reading/writing data from the operating system, configuration software and the front panel. Audio file support, including but not limited to .wav audio, shall be standard and shall be completely integrated with the unit's software tools. A non-mechanical storage device of at least 256M shall be used as the primary storage media and operating system root. The audio processing node shall include a modular I/O card bay system for support of up to four expansion cards. Each expansion bay shall be capable of supporting not less than 32 inputs and 32 outputs of simultaneous audio. Cards shall be available for microphone and line level analog audio with options for digital and proprietary audio transports. The audio node shall include a CobraNet audio transport module with support for at least 64 20-bit digital audio channels. Separate software devices shall be provided for integrating CobraNet audio I/O into the configuration file. The audio processing node shall include support for serial data transport including an RS-232 and RS-485/422 port. All data transports, including Ethernet, shall be available simultaneously and shall include software devices for integration into the configuration file. The audio processing node shall include an integrated GPIO control system with at least 16 configurable low-current, low voltage ports and 4 configurable high-current ports. All GPIO ports shall include software devices for integrating their function into the configuration file. The audio processing node shall include a front panel interface with LCD display. Navigation of the display shall include a rotary data wheel with push switch and at least four context-sensitive soft buttons. Status LEDs shall be included on the front panel for monitoring network status, storage, audio faults and power conditions. The audio processing node shall be fan-cooled with a front-panel intake and shall operate with a modular universal computer-grade power supply. The audio processing node shall be the MediaMatrix NION n6, n3, nX or approved equal.

Technical Support

When you require assistance with your product, you can get help from several sources. Apart from the online *Knowledge Center* (*http://www.peaveyoxford.com/kc*), there are many technical documents, white papers and application notes on our *website* (*http://mm.peavey.com*) and on other websites on the Internet, covering subjects including Python programming, SNMP and serial control.

If you cannot find the information you require, contact your dealer or distributor. If you are still unable to solve the issue, you can contact us directly using the details below. MediaMatrix has an extensive Technical Services Group that provides technical support, repair and implementation services.

Peavey Electronics Corp.,
MediaMatrix Division,
5022 Hartley Peavey Drive,
Meridian, MS 39305, USA.

Phone: 601.483.9548
Phone (toll free): 866.662.8750
Fax: 601.486.1678

Website: *http://mm.peavey.com* (*http://mm.peavey.com*).

Warranty statement

MediaMatrix®
PEAVEY ELECTRONICS CORPORATION
DOMESTIC (USA) LIMITED WARRANTY
Effective Date: May 1, 2005

What This Warranty Covers

This Warranty covers defects in material and workmanship in Peavey MediaMatrix products purchased and serviced in the United States of America (USA).

What This Warranty Does Not Cover

The Warranty does not cover: (1) damage caused by accident, misuse, abuse, improper installation or operation, rental, product modification or neglect; (2) damage occurring during shipment; (3) damage caused by repair or service performed by persons not authorized by Peavey; (4) products on which the serial number has been altered, defaced or removed; (5) products not purchased from an Authorized MediaMatrix Integrator. This warranty does not cover associated costs incurred from servicing equipment, including, but not limited to, travel, jobsite-related costs, fabrication, freight, loaner equipment, installation, cabling or harnessing, mounting materials or other variable costs.

Who This Warranty Protects

In applications where the product is sold *over the counter*, this Warranty protects the original retail purchaser. In applications where the product is part of an integrated system, and such system is warrantied by the integrator as a complete assembly, this Warranty protects only the system integrator.

How Long This Warranty Lasts

The Warranty begins on the date of purchase by the original retail purchaser or on the date received by the system integrator. (See *Who This Warranty Protects*, above). The duration of the Warranty varies by product as summarized below.

5 Years	MediaMatrix® DPU cards, NION™ Processing Nodes, CABs, I/O cards, Cinema Processors Power Amplifiers, Pre-Amplifiers, Mixers, Electronic Filter Sets and Dynamics Processors.
1 Year	MM Series Cardframes, MF Series Cardframes, ControlMatrix™ Host Processors, Servers and Controllers, nControl, nTouch 180, nTouch 60, xControl LCDs, nWall Remote Control Panels, Plates, Paging Stations, Ambient Sense Devices and other devices installed in user-accessible locations.
90 Days	Loudspeaker Components (including speakers, baskets, drivers, diaphragm replacement kits and passive filter networks.) and all Accessory Products

What Peavey Will Do

We will repair or replace (at Peavey's discretion) products covered by warranty at no charge for labor or materials. If the product or component must be shipped to Peavey for warranty service, the consumer must pay initial shipping costs. If the repairs are covered by warranty, Peavey will pay the return shipping costs.

How To Get Warranty Service

End Users: Take the defective product and your dated sales receipt or other proof of purchase to your Authorized MediaMatrix Systems Integrator or Authorized Peavey Service Center. System Integrators: Ship the defective product, prepaid, to Peavey Electronics Corporation, International Service Center, 412 Highway 11 & 80 East, Meridian, MS 39301, 601-483-5365. Include a detailed description of the problem, the name and location of the jobsite and a copy of your invoice as evidence of warranty coverage. Please include a complete return shipping address.

Limitation of Implied Warranties

ANY IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LENGTH OF THIS WARRANTY.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Exclusions of Damages

PEAVEY'S LIABILITY FOR ANY DEFECTIVE PRODUCT IS LIMITED TO THE REPAIR OR REPLACEMENT OF THE PRODUCT, AT PEAVEY'S OPTION. IF WE ELECT TO REPLACE THE PRODUCT, THE REPLACEMENT MAY BE A RECONDITIONED UNIT. PEAVEY SHALL NOT BE LIABLE FOR DAMAGES BASED ON INCONVENIENCE, LOSS OF USE, LOST PROFITS, LOST SAVINGS, DAMAGE TO ANY OTHER EQUIPMENT OR OTHER ITEMS AT THE SITE OF USE, OR ANY OTHER DAMAGES WHETHER INCIDENTAL, CONSEQUENTIAL OR OTHERWISE, EVEN IF PEAVEY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

If you have any questions about this warranty or service received, or if you need assistance in locating an Authorized Service Center, please contact the Peavey International Service Center at (601) 483-5365.

Features and specifications subject to change without notice.

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